AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER-MAKERS, PATTERN MAKERS, AND BLACKSMITHS.

VOL. 9, No. 44. WEEKLY. | NEW YORK, OCTOBER 30, 1886. | $2.50 per Annum. SINGLE COPIES, 5 CENTS.

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Wilson's Valve Gear.

Fig. 1 represents a new valve gear invented by Mr. Wm. Wilson, superintendent of machinery on the Chicago & Alton Railroad. The great aim in this invention is to produce a valve gear with which the point of cutting off steam in the cylinder can be changed without interfering or changing the action of the exhaust, and also to maintain a constant lead at whatever point the steam in the cylinder may be cut off. The advantage gained by the use of this valve gear is the saving of fuel, because with this the opening of the exhaust and its closure will always occur at the same points of the stroke, and cannot be changed or affected by an early cut-off, and thus there will be no back pressure until compression commences. Indeed, the indicator cards from an engine in which this link motion has been employed show an entire absence of back pressure until the exhaust closes, which occurs at 79 per cent. of the stroke, and thereby giving a compression which is ample for all purposes without being excessive, as is often the case in ordinary locomotives.

In order to obtain this result two slide valves in each steam chest are used. The duty of one is to admit the steam into the cylinder, and also to cut off the steam in the same. This valve we shall hereafter call the "steam valve." The other valve controls the opening of the exhaust and its closure. This valve we shall hereafter call the "exhaust valve." The design of the exhaust valve is such so that the opening of the exhaust will occur at 92 per cent. of the stroke, and the closure of the exhaust—as we have stated before—at 79 per cent. of the stroke. All the slide valves are small and of multiple port form, or which some authorities call the "grid-iron valve." The travel of the steam valve is 3½ inches, and the travel of the exhaust is 2 inches. The size of cylinder for which these valves are used is 17 inches diameter and 24 inches stroke. The motion of both valves is derived from one eccentric, but yet the construction is such that each valve will have a separate and distinct movement from the other. In order to show this distinctly we have represented in Figs. 2 and 3 all the mechanism employed for working the steam valve only, Fig. 2 showing an elevation, and Fig. 3 the plan of the same. Fig. 4 represents the mechanism employed for working the exhaust valve, and Fig. 1 is a combination of Figs. 2 and 4, or, in other words, Fig. 1 is a complete representation of the link motion.

The position of the steam and exhaust

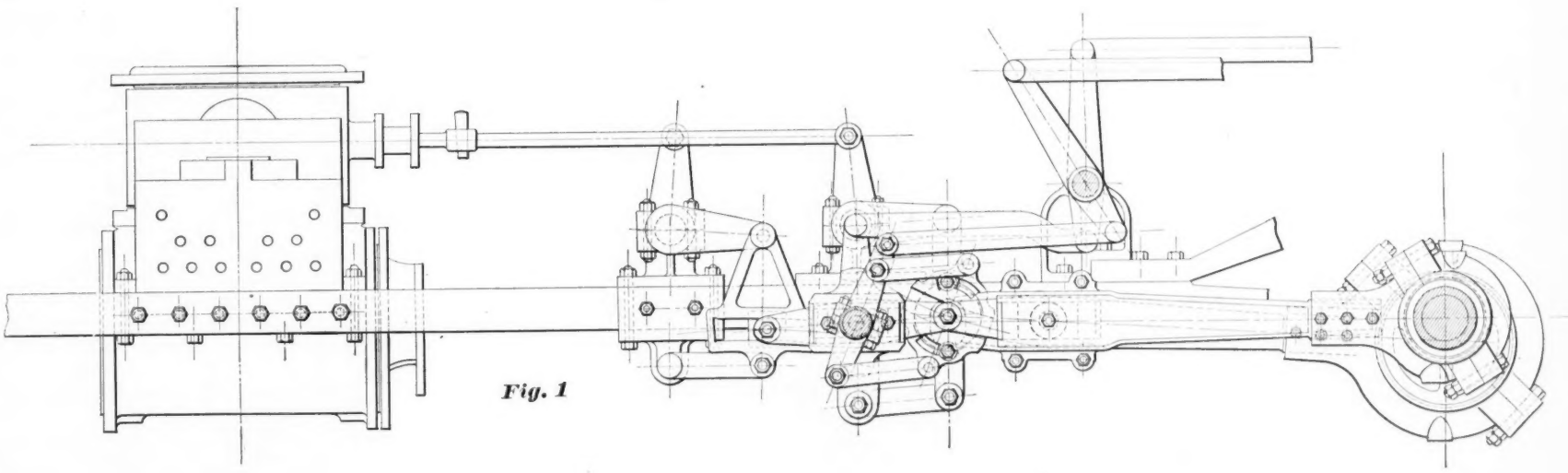


Fig. 1

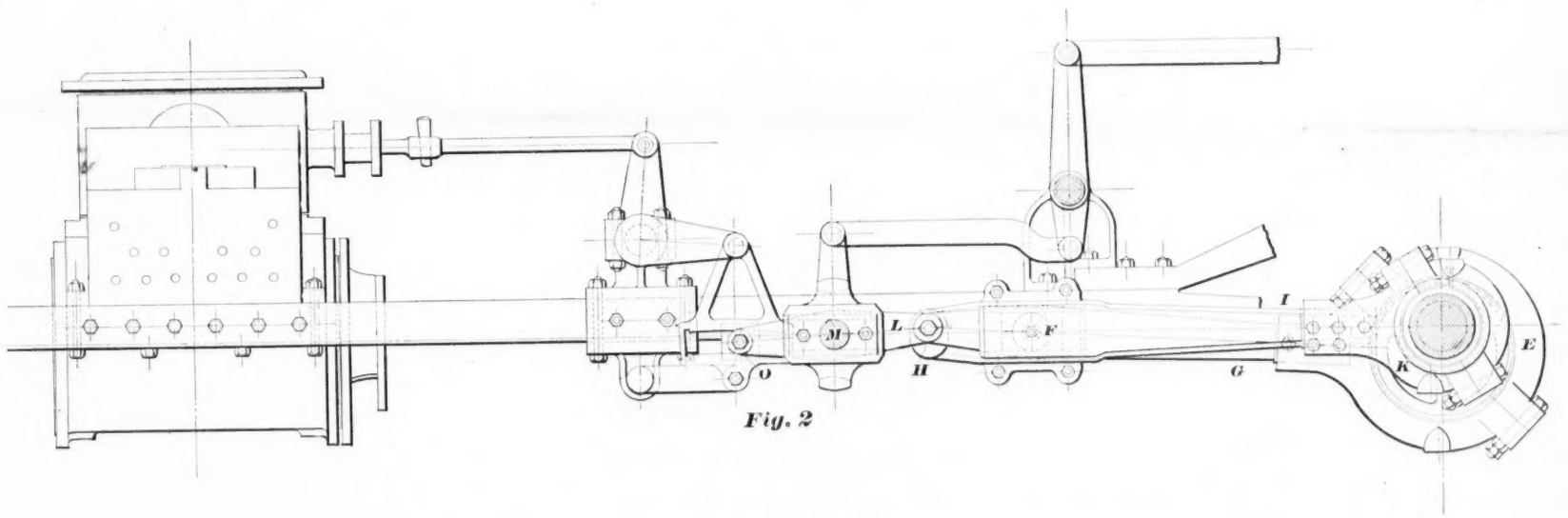


Fig. 2

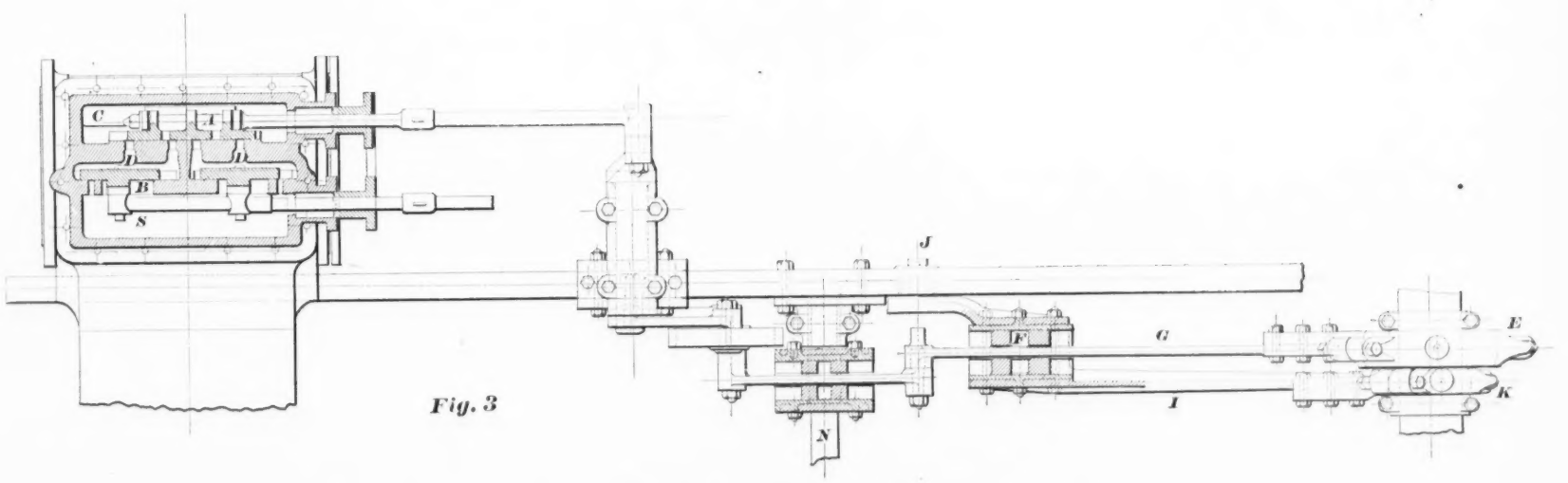


Fig. 3

WILSON'S LOCOMOTIVE VALVE GEAR.

valve in the steam chest is clearly shown in Fig. 3; here it will be seen that the steam chest is partitioned into four parts, the partitions running parallel to the axis of the cylinder are the valve seats. *A* is the steam valve and *B* is the exhaust valve. Steam from the boiler enters into the space *C* of the steam chest, from thence the steam valve admits the steam into ports *D*; after the steam has performed its work in the cylinder it is released by the exhaust valve *B*, and escapes through the space *S* out into the air. Now, referring to Fig. 2, it can readily be seen how the steam valve receives its motion from the eccentric. The eccentric *E* is set at right angles to the crank, or, as the mechanic would say, it is set square with the crank.

The piece *G* connected to the strap may at first sight appear to be an eccentric rod, but it is not, it is a lever because it works on the fulcrum *F*, and therefore we shall call the piece *G* an eccentric lever instead of "eccentric rod." Considering the eccentric lever and strap to be one piece we may say that the end of the eccentric lever *G*, near the driving axle, has a circular motion, and the other end, or rather the center of the pin *H* which is fastened to the forward end of the eccentric lever, describes an oval The fulcrum *F* is placed in such a position so that the smaller diameter of the oval described by the center of the pin *H* is equal to twice the lap and the lead of the steam valve, and the larger diameter of this oval is equal to the throw of the eccentric, or, that is to say, the larger diameter of the oval is equal to twice the eccentricity of the eccentric.

This oval movement of the pin *H* must be constant, or, in other words, the length and breadth of the oval must not be changed. To preserve its constancy, which might be affected by the irregular position of the driving axle in the pedestals, a bar, *I*, is employed, which carries the bearings for the fulcrum *F*. The forward end *J* of this bar is correctly pivoted to the frame on the proper line of motion. The rear end of the bar *I* is carried by a small disk, *K*, placed on the driving axle, the centers of both being identical or concentric. Now, since the fulcrum of the eccentric lever *G* is supported by the bar *I*, whose forward end *J* cannot move out of the center line of motion, it follows that the constancy of the oval described by the pin *H* is maintained. The periphery of the disk *K*, or we may say, the periphery of the concentric *K* is turned so as to form part of a sphere whose diameter is equal to that of the concentric. In a similar manner, the periphery of the eccentric *E* is turned so as to form part of a sphere whose diameter is equal to that of the eccentric. Turning the concentric and eccentric to these forms will insure parallelism to the gear, while allowing the axle the latitude it must necessarily have in moving over a rough track. The pin *H* imparts motion to a horizontal lever, *L*, which has a fulcrum, *M*, in the center of its length. The bearings of this fulcrum *M* are carried by guides in the reversing shaft *N*. This shaft is held in position by bearings fastened to the frame, and can partly rotate in either direction by the reverse lever connections peculiar to the locomotlve (or, if this link motion is used on a stationary engine, this reversing shaft can be moved in either direction by the governor).

Again, since the bearings of the fulcrum *M* travel in a horizontal direction when the link motion is set in mid-gear, it follows that the oval described by the center of the pin *O* will be precisely the same as that described by the pin *H*, and thus obtaining the shortest travel of the valve when in mid-gear, and at the same time obtaining a port opening which is equal to the lead. On the other hand, when the reversing lever is turned in its bearings by the means of the reversing lever, the bearings of the fulcrum *M* are made to move out of their horizontal direction, and thus the travel of the valve, the port opening, and also the power of the engine is increased. Lastly, the direction in which the reversing lever is turned will govern the direction in which the engine is to move. The pin *O* moves in a slottted yoke, which is connected to the valve by a rocker, having its arms at right angle to each other, and a valve rod between the rocker and the valve.

Referring to Fig. 4, it will readily be seen how the exhaust valve receives its motion. The outlines of the eccentric *E*, and the concentric *K* in this figure, represent the same eccentric and concentric as those shown in Fig. 2; in fact, the drawings, from the axle to the pin *H*, Figs. 2 and 4, represent the same mechanism.

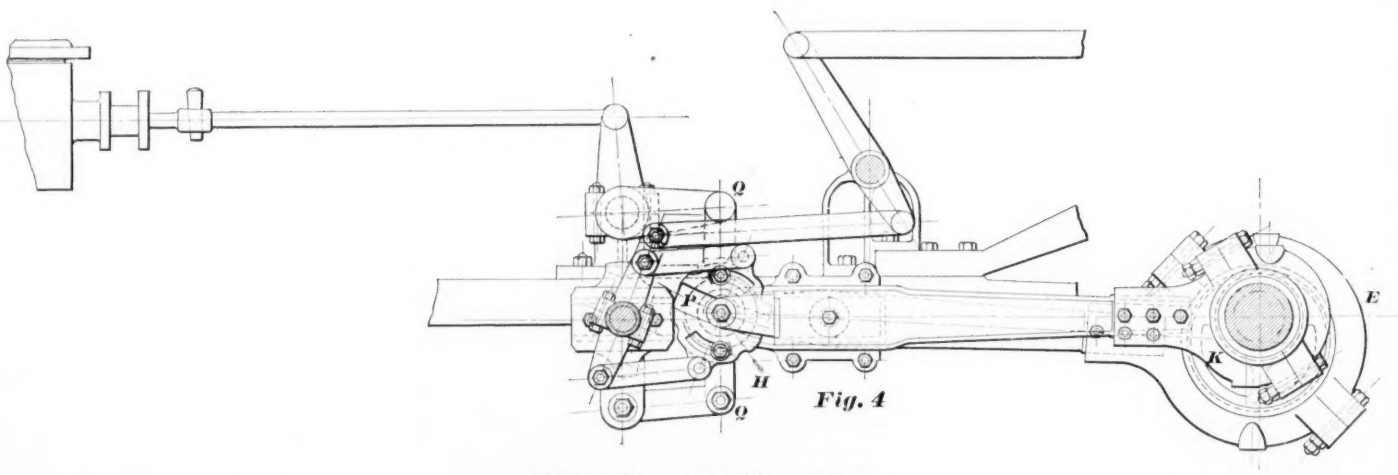


Fig. 4

Wilson's Locomotive Valve Gear.

The pin *H* carries a block, which travels in a small slotted yoke, *P*. This yoke is pivoted to a vertical lever, *Q*, and arranged to partly rotate on its pivoted bearings, by a lever connection in the cab. The vertical lever connects to a rocker whose arms are set at right angle to each other, and a valve-rod connects the valve and rocker.

It will readily be seen that, since the slot in the yoke *P* has an inclined position, the pin *H*, which travels in this slot, must move the vertical lever up and down, and thus communicate motion to the exhaust valve. In reversing the engine, the yoke *P* is turned so that the position of its slot will be inclined in an opposite direction.

A few locomotives with this valve gear are now running, and, we are informed, give satisfaction.

Practical Drawing.

By J. G. A. Meyer.

Second Paper.

10. We will refer again to Fig. 1. Take, for instance, the side of the die upon which is the single dot, and let this dot represent the center of the side. Now, imagine a straight line *a b* to be drawn through the dot and perpendicular, that is, as the practical man would say, square with the surface, and for the sake of simplicity suppose that we are looking at the object with only one eye, and the eye placed so that the line *a b* will pass through the position of the eye, then all we can see of the die is simply one side;* namely, the side with the dot, and it will appear to the eye as shown in Fig. 2.

Here, then, we have a drawing that will show all the lines parallel, because the edges of the die are parallel, and all the lines of equal length and square with each other as they should be, and consequently a true representation of the shape of one side of the die.

* It will hereafter be explained that the position from which we view an object should be taken an infinite distance away from the object.

11. Now we can treat all the other sides in the same manner, and then, if we place these different views according to some fixed law, we have a drawing like Fig. 3 that will meet all the requirements of the mechanic or practical man, and a drawing of this kind we shall hereafter call Practical Drawing.

12. If a practical drawing represents a machine or any part of it, such a drawing is called, according to custom, a "mechanical drawing." If this drawing represents a building or any separate parts of buildings, it is called an architectural drawing, and if the drawing represents the details of a ship, or the ship itself, it is called naval architecture.

But any drawing that has for its aim the representation of true form, so that the workman can use it for a guide, is, as we have already seen, based upon certain rules laws and principles, which are equally applicable, without any change, whether a machine, building or ship is to be represented.

We, therefore, include the so-called mechanical drawing, architectural or naval architectural drawing under the general term of practical drawing.

13. Now let us take a glance back, and see what we have learned. We see then, that in the first place we can make a drawing of an object without the aid of any instrument except the pencil, allowing our eyes and good judgment to be our guide, and this is called a free hand drawing.

Again, a drawing of an object made correctly according to some particular science, with the aim that it will represent the object precisely as it appeared to the eye, and at the same time have a pleasing outline, such a drawing is called a perspective drawing.

Lastly, if we make a drawing of an object based upon the same science just mentioned, but with the aim of showing its true form, we have a practical drawing.

14. The reader must have noticed that we have repeatedly alluded to some particular science upon which practical drawing is based, and he may have asked, "What is this science called?" The answer to this is simple, for it is the science of geometry.

Fig. 2

15. Geometry is a branch of mathematics, and its importance we can better conceive, when we remember, that in whatever country mathematics is taught, the science of geometry remains the same, whether it is taught in the English, French, German or any other language. We therefore conclude that if a practical drawing is made according to the rules of geometry in a country where the English language is spoken, it will be equally well understood and as easily read in a foreign country where a different language is used.

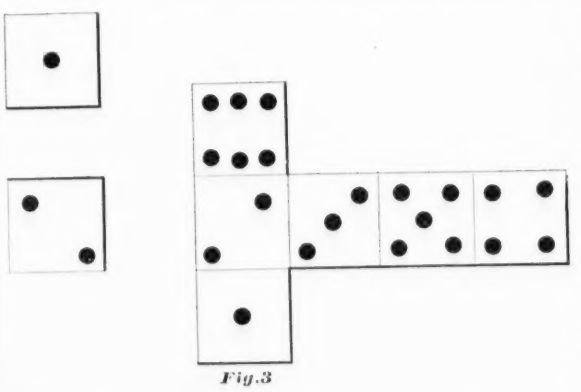


Fig. 3

16. We are now in a position to give a better definition of Practical Drawing, and state it in this manner.

Practical Drawing is the delineation of the true form of an object, the delineations being based upon geometrical principles.

17. But before we can apply these geometrical principles we must understand them, hence we see the necessity of the knowledge of geometry.

In this treatise we shall only explain such parts of geometry as are absolutely necessary for a clear understanding of practical drawing, and of this limited portion we shall give only so much at a time as our progress demands.

18. Seeing then the importance of the knowledge of geometry, let us inquire what kind of science geometry is. The first we have to deal with is elementary geometry—a science which consists in the development of all laws relating to space, and is made up of the processes of rules by means of which portions of space can be best compared with each other. Now, as space is the subject of all geometrical reasoning, and to which all the truths of geometry are applicable, it becomes necessary to form a clear conception of space. Every material object occupies a limited portion of space, and this space considered separately from the matter of which the body is composed is called a geometrical solid. On the other hand the material body which occupies the given space is called a physical solid. For simplicity, then, in the commencement of our study of practical drawing, we will only take into consideration a geometrical solid which is merely a limited portion of space occupied by a physical body, and does not necessarily involve the idea of matter.

19. In a general way, portions of space corresponding to physical bodies are called figures or geometrical magnitudes, of which there are three general classes:

1st. Lines.
2nd. Surfaces.
3rd. Solids.

In order to gain a full and clear understanding of our subject it is necessary to give names to the different kinds of lines and forms, and to define these names accurately. These names are all taken from the science of geometry, but since in a treatise like the present one, more stress is laid on the application of geometry than on the complete study of geometry itself, the order in which the definitions will be placed is somewhat different from the order adopted in elementary geometry. We would most strongly recommend that the student will commit these to memory, as such a course will make his progress much easier.

Definitions.

20. A Line is that which has length, but neither breadth nor thickness. The limits or extremities of a line are points.

21. A Point is that which has position, but no magnitude or extension.

22. Since the finest line that we can draw has breadth, and the smallest point or dot that we can make has extension, it is necessary to impress upon the student's mind that lines so drawn, which we can call physical lines, simply represent those mathematical lines

which have no breadth, and the dot merely represents the position of a point in space. We therefore repeat that lines, either straight or curved, must be understood to have no breadth, and a point no extension. When this is understood, the use of physical lines or points will not affect the correctness of our reasoning, but will aid us to gain a clear conception of our problems.

Lines are divided into two classes—straight and curved.

The constructions of ordinary problems are effected by means of the straight line and the simplest kind of the curved lines, which is the circumference of a circle.

23. A straight line is one which does not change its direction at any point, or we can say that a straight line is the shortest distance between two points.

24. A curved line, or simply a curve, is a line no portion of which is straight, but changes its direction at any point.

25. A surface is that which has length and breadth without thickness.

Surfaces are divided into two classes—plane and curved surfaces.

26. A plane surface is such that if any two of its points be joined by a straight line, that line will lie wholly in the surface.

The practical man will here recognize what he would call a true flat surface—such that if a straight-edge be applied to any part of the surface, any point of the straight-edge will touch it. Such a surface we understand to be in geometry a plane surface, and, in order to avoid repetition of words, we shall in the future simply call it a plane.

27. A curved surface is neither a plane nor composed of planes; in other words, a curved surface is a surface no portion of which is a plane.

Traction on Grades.

By A. B. Ropes.

In a previous article I outlined the method of computing the tractive power of any engine from the mean effective pressure of the steam in the cylinders, knowing the size of cylinders, their stroke and the diameter of the drivers. I will now endeavor to explain how more power is required to pull a train up a grade than on a level track at the same rate of speed, and the relation which the inclination of the grade has to the extra amount of power required.

An engine pulling a train on a level track does not overcome the resistance of gravity. The resistances which it does overcome are flange friction, friction of journals, and machinery, and the resistance of the air. As soon as the direction in which the train is moving departs from a horizontal one and begins to ascend, the engine has, besides the resistances already mentioned, to overcome a force which is tugging to pull the train to the center of the earth, *i. e.*, the force of gravity. What this force is we do not know; indeed, what any of the forces are we do not know; but we are familiar with their effects, and by observing their effects and operation we may form rules to guide us in experimenting in hitherto untrodden paths.

On a perfectly level track the train is prevented from moving toward the center of the earth by the rails which resist the effort of gravity to just the extent of this effort, and the train is held in equilibrium. We may, perhaps, best be able to study the workings of the force of gravity in this connection by means of a little apparatus. Let *D* represent a board, *A* a nail driven into it near one end, *B* a block which we will say weighs 10 pounds, and *C* a string which connects the block and nail. In Fig. 1 we have a parallel case to that of the train on the level track. The force of gravity acts on the block in the direction indicated by the arrow; but the force is resisted by the board *D* and the block stands in equilibrium. There is no tension on the string, and as soon as we apply sufficient force to the string in the direction of the nail to overcome the frictional resistance of the block on the board, the block will move, and as soon as the force applied to the string be removed the block will stop—again in equilibrium. Evidently, in this arrangement the greatest strain on the nail cannot exceed the force required to overcome friction between the block and board. In Fig. 2, however, the conditions are changed; about the only thing remaining in the same is the force of gravity. That is always there and all there, and acts in the same direction as before. Now, however, the board does not resist the movement of the block as it did before, but it is the nail which offers all of the resistance through the cord to the movement of the block. The cord may be cut between the block and nail, a spring balance inserted and the attraction measured in pounds, and we will find the resistance of the cord and nail where the board is in the position shown in Fig. 2 to be 10 pounds. A parallel to this case is not met with in railroad practice, as grades are not made vertical; but the difference is only one of degree, and if we can find the tension of the cord for different degrees of elevation of the board we will have made a long step towards understanding the method of finding the resistance which an engine will have to overcome on grades of various inclinations.

Fig. 2

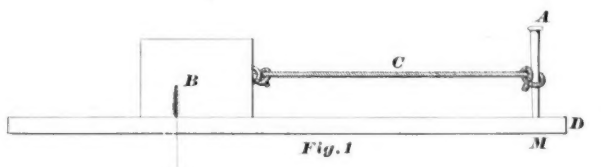


Fig. 1

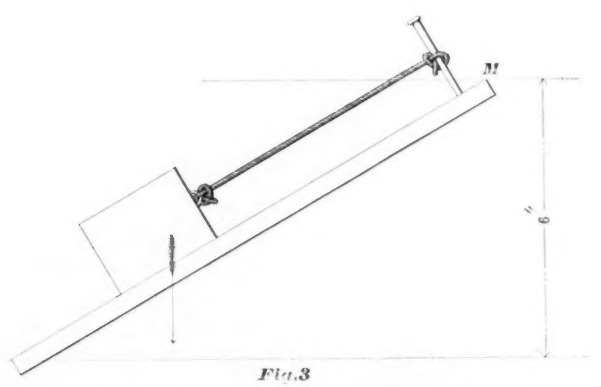


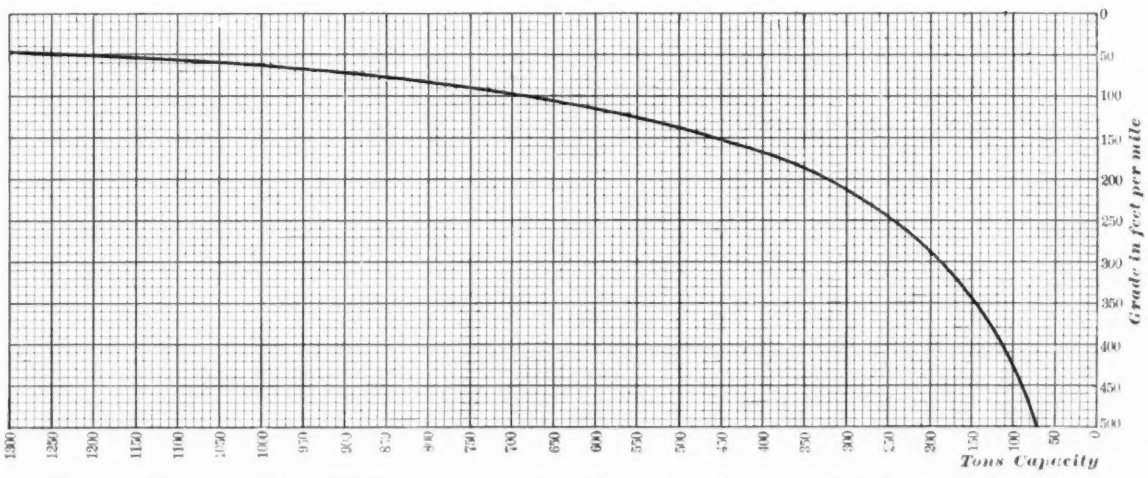
Fig. 3

Before we begin let us remember that the force of gravity is constant for any particular mass, and that therefore it tries to draw our block toward the center of the earth with a pull of a certain amount, and that amount does not change. In these investigations we shall, for simplicity, disregard friction.

In the arrangement shown in Fig. 1, the attraction on the block is 10 pounds, which is resisted by the board. In the arrangement as shown in Fig. 2, it is also 10 pounds, resisted by the nail. In the arrangement shown in Fig. 3 the force remains equal to a pull of 10 pounds, and is resisted by the board and the nail. What is not held by the board is supported by the nail, and *vice versa*. But the sum of the resistances offered to the motion of the block by the board and nail will always be equal to 10 pounds.

Let us suppose our board to be 12″ long. If it be horizontal, the resistance it will offer to the motion of the block will be 10 pounds, as we have seen. If it be perpendicular, the nail will offer this resistance. If now, the end *M*, Fig. 1, of the block be raised 6 inches, or half the length of the board, the nail will support half the weight of the block, and the board the other half. If we elevate the end *M* $\frac{1}{3}$ of the length of the board, or a distance of 4 inches, the nail will support $\frac{1}{3}$ of the weight of the block, and the board $\frac{2}{3}$. The tension on the string is, of course, in every case equal to the pull on the nail. Thus we see that the relation between inclination and resistance offered by the nail to the motion of the block is quite simple, and may be thus stated.

The resistance of the nail to the motion of a block weighing unity is equal to the elevation of the end of the board, divided by the length. For a block of any weight we have but to multiply the resistance of the nail to the motion of the block weighing unity, by the weight of the block in question.



Tractive Power of 22″ × 26″ Engine, exclusive of Engine and Tender. M. E. P. 127.5 lbs. Wt. of Engine and Tender, 231,000 lbs.

We have now all of the preliminary knowledge necessary for making an examination of the resistance of gravity to the motion of a train up any grade. Take for our first instance a train weighing 100 tons on a grade of 80 feet per mile, apply our process of reasoning, and we see at once that if the road were built up the side of a perpendicular cliff the engine would have to exert a tractive force of over 100 tons to move the train, and on a level, the resistance of gravity to the motion of the train would be zero, as far as the engine was concerned. Therefore for an 80 foot rise in 5,280 feet the resistance of one ton would be $\frac{80}{5280} = \frac{1}{66}$ of a ton, and the train of 100 tons would offer a resistance of $\frac{1}{66} \times 100$ tons=303,030 lbs. in addition to the force required to pull the same train at the same speed on a level track.

For example let it be required to find the power required to haul a train of 600 tons up a grade of 60 feet per mile at a speed of ten miles per hour. We will call the resistance on a level track at ten miles per hour 6.6 lbs. per ton. These figures have been derived by experiment on a number of cars of different makes and weights and have been accepted for some time as nearly correct. The resistance per ton on a grade of 60 feet per mile will be $\frac{60}{5280}$ of a ton=22.7 lbs. This added to 6.6 lbs. will give a total of 29.3 lbs. per ton, which in a train of 600 tons would amount to $29.3 \times 600 = 17580.0$ lbs.

We can now go farther and ascertain the capacity of any engine on any grade, providing we know the tractive power of the engine, which we can find from the rules given in the article on "Traction and Adhesion" in the issue of August 28th. Let us suppose an engine with cylinders 16″ × 22″, drivers 54″ diam., M.E.P. 120 lbs. per square inch as a maximum. How many tons will she pull over a grade of 60 feet per mile at a speed of ten miles per hour? The tractive power of the engine will be

$$\frac{16^2 \times .7854 \times 120 \times 88.}{169.6 + 6} = 125.55 \text{ lbs.}$$

The resistance on a level at ten miles per hour we will take as 6.6 pounds per ton, to which we must add the resistance due gravity, which will be

$$\frac{60 \times 2000}{5280} = 22.7 \text{ lbs.}$$

per ton. The total resistance therefore will equal $22.7 + 6.6 = 29.3$ lbs. per ton.

The tractive power being 12515 pounds the engine will haul

$$\frac{12515}{29.3} = 427 \text{ tons}$$

up the grade.

The varying power of any engine on grades of different inclinations may be very prettily shown by means of a graphical table, which may be thus constructed:

Draw a series of equidistant horizontal lines and a series of equidistant vertical lines intersecting them. Let the horizontal lines represent grades in feet per mile, and the verticals tons capacity of any engine. The spaces between horizontal lines should not represent more than an increase of ten feet per mile in grade, and the spaces between verticals not more than ten tons capacity in order to have the table appear to the best advantage. For each horizontal line, figure the tons capacity of any engine, assuming the mean effective pressure, and place a dot on the horizontal line at the point showing the requisite capacity. Connect these dots by a line and we will have a curve showing the rate of decrease of capacity for increase of grade.

Of course several engines of different capacities may be placed on the same sheet or the capacities of one engine working at different points of cut off be compared.

Computations should only serve as a basis to work from in assigning loads to engines. Actual trial alone will convince where the results of computations leave room for doubt. A thorough understanding of these simple principles may often be of use at times and places where a book of reference is not at hand.

A Russian plan for the removal of rusty screws is to heat a flat iron bar to a cherry red and press it on the head of the screw for a minute or two, after which the screw becomes loosened, and is easily extracted with a screw-driver.

"Beautiful Homes and How to Build Them," is the title of a neat little pamphlet published by W. B. Judson, editor of the *Northwestern Lumberman*, of Chicago.

There are nineteen designs for brick and frame dwellings, a church and a school. The engravings are attractive. They are colored, which heightens the attraction. The book is sold at 50 cents, post-paid, and is well worth the money. Scale drawings of any of the plans will be furnished at not to exceed $3.00.

New Two-Spindle Centering Machine.

The engraving represents a machine recently put on the market by the Pratt & Whitney Company, Hartford, Conn.

The machine will drill and counter-sink the centers in shafts of 3″ diameter, and smaller, of any length. For large shafts over 5 feet in length, a support beyond the machine may be required. The shaft is held central with the operating spindle in the right and left hand screw vise, and an adjustable rest, movable on the bed, supports the other end. The spindles are independent, and are driven at different speeds. They are both operated by the same handle, which also swings the drill spindle away and the countersinking spindle into position for work, and the reverse.

The machine is furnished with oil tank, and countershaft having 7 by $2\frac{3}{4}$″ tight and loose pulleys, and should make 175 revolutions per minute, and weighs 460 pounds.

Tests of Iron at G. W. Brown & Co.'s, Galesburg, Ill.

BY DAVID SPENCE, FOREMAN.

Before giving orders for the season's stock of iron, we made some tests, which are tabulated below. The size of test bars were $1\frac{7}{32}$ inch by $1\frac{3}{32}$ inch, and 2 feet in length. The tests were made on a scale, with facilities similar to those described by Robert E. Masters, in the AMERICAN MACHINIST of April 24, 1886. These tests seem to show that Southern soft and Northern hard iron make a strong mixture, or Northern soft and Southern soft make a strong, tough mixture.

It will be seen that some of the tests come up to 1,800 lbs. In these tests the edges of the pieces were up. The other tests were made with the pieces placed flatways.

After making the tests as below, I made some tests with bars, one inch square, 24 inches long, and obtained the best results I ever saw. Some of the pieces required as high as 1,400 lbs. to break them. The iron was fine and open, and would finish up well in the lathe, and could be readily drilled. Our castings are for agricultural work, and there is a good deal of drilling to be done on them.

The Rockwood is a soft Southern iron, the Lagrange a hard Southern iron, the Appleton and Antrim hard Lake Superior irons, and the Hubbard a soft Ohio iron, or, as we term it, the "American soft Scotch."

The table is self-explanatory, except that (1) refers to pieces cast in the first part of the heat, (2) to those cast at the middle, and (3) to those cast at the last of the heat. Some of the bars bent $\frac{3}{4}$ inch before breaking.

TESTS OF IRON.

Test No. 1.

⅓ Antrim,	Broke at	(1)	1,320 lbs.
⅓ Hubbard,	"	(2)	1,660 "
⅓ Machine scrap,	"	(3)	1,500 "

Test No. 2.

⅓ Lagrange,	Broke at	(1)	1,385 lbs.
⅓ Hubbard,	"	(2)	1,600 "
⅓ Machine scrap,	"	(3)	1,800 "

Test No. 3.

⅓ Rockwood,	Broke at	(1)	1,500 lbs.
⅓ Antrim,	"	(2)	1,503 "
⅓ Machine scrap,	"	(3)	1,810 "

Test No. 4.

⅓ Appleton,	Broke at	(1)	1,410 lbs.
⅓ Rockwood,	"	(2)	1,580 "
⅓ Machine scrap,	"	(3)	1,490 "

Test No. 5.

⅓ Appleton,	Broke at	(1)	1,450 lbs.
⅓ Hubbard,	"	(2)	1,580 "
⅓ Machine scrap,	"	(3)	1,625 "

Test No. 6.

⅓ Lagrange,	Broke at	(1)	1,495 lbs.
⅓ Rockford,	"	(2)	1,490 "
⅓ Machine scrap,	"	(3)	1,545 "

Test No. 7.

⅓ Appleton,	Broke at	(1)	1,500 lbs.
⅓ Rockford,	"	(2)	1,640 "
⅓ Machine scrap,	"	(3)	1,550 "

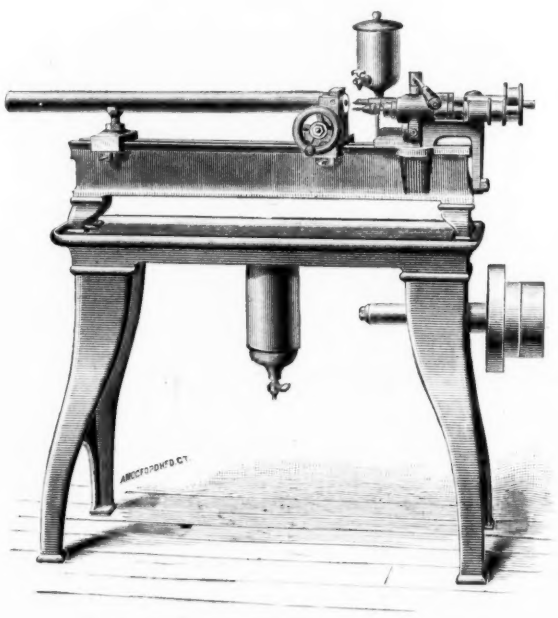
By a majority of 110 in a total vote of 2,752, Davenport, Ia., voted a 3 per cent. tax for the benefit of the Davenport, Iowa and Dakota Railroad—a projected line to the Northwest. The amount of the tax will be $125,000.

Machine Tools for Pattern-Makers.

BY F. W. BARROWS.

Pattern-making, like the machinist's trade, is getting to be simply a question of a man's ability to manage the machines which do the actual work. A pattern-shop fitted up with improved wood working machines, gets along without much hand-work, other than what may be necessary in putting the work together. It is possible to keep machine tools, not only the lathe, but the circular saw and the planer, in such shape that work may be cut right down to the line, although there are some other things to be considered beforehand. By the way, why is it that the pattern-shop, with all its high-speed machinery, is located at the top of the building? This is usually the case, although I know of one shop that is located on the ground floor, and another that is now at the top of a three-story building, used to be located under the foundry.

High-speed machines need a solid foundation. A buzz planer running 4,500 revolutions a minute, will soon show you if there is any spring to the floor it may stand on, especially if the driving belt is so laced that, every time the lacing runs over the pulley, it



NEW TWO-SPINDLE CENTERING MACHINE.

has the same effect as a blow struck on the spindle. A lacing seems like a little thing; but when it is fixed in a belt, and traveling at a speed of about 4,500 feet in a minute, it becomes a factor which must be considered, if you wish to get the best results from the machine.

Did you ever notice the difference between a machine whose driving belt was strained up like a fiddle-string, with the lacing so prominent that you could hear it all over the room, every time it goes over the pulley, and a machine whose driving belt was just tight enugh to do the work well, with the lacing, or fastening, so made that it makes no noise as it pases over the pulley? The first machine will get hot, do poor work, and will impress anyone not used to it, with an uneasy feeling, as if something was wrong, while the second machine will run all day as cool as a cucumber; and the man running it can do more and better work, because he knows that the machine is all right, and therefore he can give his whole attention to the work.

This belt question I consider of more importance than is usually allowed for in practice. In many cases, the cure-all for a machine that is not working right is to take a little out of the belt. This is, sometimes, like giving a tired horse the whip, when it's oats he wants; or, to make my meaning plainer, be sure that your horse, or macine, is in good running order before putting on the whip. With the machine in good order, and the belts properly arranged, they need never be tight enough to cause any trouble about heating the boxes, or in making the spindle they may drive jump so that you can hear it and feel it, and also see it on the work. This jumping is generally owing to the unevenness of the surface of driving belt; often it is caused by a lacing badly put in, which makes a lump on the inner surface of belt, and pounds on the pulley every time it passes over the latter. This we can remedy by using an endless belt, or some form of lacing that will make a smooth joint, and thus imitate an endless belt, the great virtue of which lies in the fact that it has no joints, and, therefore, will run perfectly smooth. It may still be too tight, and make the journals get hot. This can only be cured by judgment and skill in the care and management of the machine.

An excellent way of lacing a driving belt for a high-speed machine is to hold the ends together, and sew them with tough, strong wire, making the stitches as short as possible. This is the best thing I ever saw for a lacing in a fast-running belt.

I think that the circular saw will rank first among machine tools for the pattern maker. A great variety of work may be done with a sharp saw that is mounted on a good table.

In using a circular saw, the first thing to attend to, after we know that the belts are all right, is to see that the saw itself is in good order. Now, I am not going to give any rules for sharpening saws, but will just say what has been my experience. It would, in fact, be rather difficult to make any fixed rule in regard to setting and filing saws without first knowing just what they were to be used for.

For pattern work, a saw needs to be kept sharp, jointed true, but as the lumber is dry and soft it won't need much setting. A saw may fill these two first conditions and still not do a good job, because of the way the saw has been set and filed. It may have been set unevenly, or when the teeth were not all of a length. The saw should be jointed before removing from the arbor.

If you use any kind of a set that slips over the tooth until a gauge touches the point of tooth, you can see the object of jointing the saw before setting. It isn't necessary to set the saw every time we file it, and for this reason we should be particular, when it is necessary, to set the teeth all just alike, and as the point of the tooth is usually the guide in setting the saw, it is evident that the points should all be at the same distance from the center of arbor. This is accomplished by jointing the saw while it is running in position.

As to the filing, I have found that a splitting saw, if filed as near square across the saw as possible, gives the best results. It cuts freer, leaves the stuff smoother, and will keep sharp as long as a saw which is filed at an angle or fleaming.

If you believe in filing the teeth at any angle with the axis of saw, let me show you something which perhaps you have already

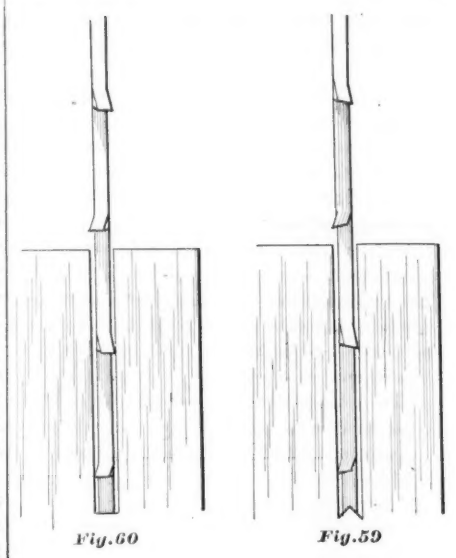


Fig. 60 *Fig. 59*

noticed and can explain to your own satisfaction. After you have sharpened your saw take a piece of lumber and try it. After cutting in a little way, stop and see the shape of the end of kerf. The points of the teeth have cut ahead and left the wood in the middle of kerf, projecting back towards the saw. What cuts away the wood that forms this point? It must of course be removed by whatever edge the tooth may have crosswise of the saw. With the saw filed as in Fig. 59 (which also shows the point of wood left at the end of kerf) there cannot be a very thin edge, and consequently it won't be an edge that will cut wood, and as it will require some crowding to make it tear or bruise off the wood, won't the crowding tend to force the points of the teeth away from the center of the cut, making the saw cut a wider kerf than it should, and checking the speed until it runs slowly enough for each tooth to be heard as it enters and leaves the wood? Then the saw will rattle, until it has cleared for itself a little wider channel. At the same time you will stop crowding the piece of stuff, and the saw will have a chance to regain its speed, when it will run on again for a little space, the distance or time between two of these spells being governed by the kind of lumber, keenness of the saw, and the amount of force used in pushing the stuff up to the saw.

Is this the way you have explained it to yourself? I claim that the cutting edge of the teeth on a spliting saw should be as nearly as possible at right angles with the grain of the wood operated upon. This is accomplished by filing the saw square across, both the front and top of tooth, as in Fig. 60, which leaves every tooth with an edge or point like the edge of a chisel. What sort of progress would a man make in beating mortices with a mallet and chisel if he continually left the ends or heads in the shape of the end of kerf in Fig. 59? Doesn't he get along best when he places the edge of his chisel square across the grain? Of course he does, and so will a splitting saw cut the best when the teeth cut like chisels and strike the wood square across the grain.

For a cross-cut saw the points of the teeth should "resemble the point of a knife, so as to cut off the wood at each side of the kerf." The center of the kerf will take care of itself now.

You will find that a splitting saw filed square across, in going through a piece of stuff cuts away the wood in the form of shavings, not sawdust, and it will also require less crowding and will cut cleaner and smoother. In short, it is the right way to file a splitting saw. But I am afraid that I have set down a rule, and a very arbitrary rule, for filing splitting saws. Well, try it, and see for yourself.

Don't let your saw get worn off on the sides of teeth, because then it won't cut, but will bruise or tear the wood. A saw which cuts nothing but dry pine won't get this way, and a saw which is kept sharp won't either.

I intended to write something about what may be done with a circular saw, but will have to say, as the story papers do, "to be continued in our next" article.

About Reamers.

By A. User.

To make a tool that shall cut a smooth, true hole is a job in which people are not always successful, and many are the shapes that have been devised. The rose reamer having teeth only on the end, and nearly cylindrical, but slightly tapered smaller toward the shank, behind them, is a good one for holes that are broken into on the side, and holes in general where there is but very little to come out, until it gets worn a little, when it is apt to bind, making trouble and perhaps spoiling or injuring both the hole and the reamer.

A fluted reamer is liable to chatter, and to cut the hole out of round, the hole having one more corner or side than the reamer has teeth; thus a square reamer will sometimes make a five-sided hole, a reamer with five teeth a six-sided hole, etc. The chattering can often be prevented by spacing the teeth unevenly; on taper reamers especially this is a good plan, for half way around the reamer, making each tooth spaced a little wider or narrower than the last, then begin again the same as at first and make the second half the same as the first, then every tooth will be opposite to one just like it, and no two consecutive teeth will be alike.

I have seen reamers with the teeth a little spiral, every other tooth twisting one way and the others the opposite way. That would do very well for a short taper reamer, of little taper, but as it was on straight reamers that only cut at the end, it didn't amount to much.

Square reamers are used for gun barrels, to finish the bore to size. A piece of wood is put on one side, to crowd it to the other side of the hole, and paper is put under that to get the hole exactly the right size. They are run quite fast, twice as fast as a drill of the same size would ordinarily be run.

A left-hand thread is sometimes cut on a taper reamer, which breaks the chip and keeps the tool from running in too fast, but if you want a good hole do not do it unless you have something to grind the reamer true after hardening. One lip is likely to be higher than the others, and it is easy to imagine the result.

A good way to make a reamer for chucking is to make it like a rose reamer on the end, but have it fluted, making the flutes two or three times as wide as the tooth that is left, and do not back off the teeth. For hand use make it the same, but give it considerable taper, backing it off of course where the cutting is done. It is well to give it a very slight taper, smaller toward the shank. Then if your back center happens to be a little out of line, in chucking, you will still escape making a tapering hole.

Half-round reamers are also used. They are easier made than fluted ones and are sometimes very serviceable.

Building Associations in Two Cities.

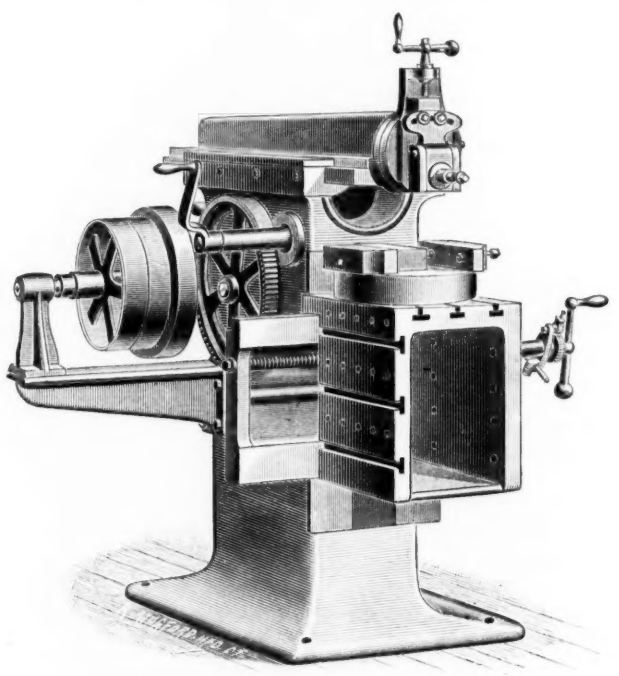
(From the *Chicago Herald.*)

"We cannot have too many well-managed building associations in Chicago," said a manufacturer. "I have just been spending a few days in Philadelphia, and they told me there that the immunity of that city from labor troubles is in large measure due to the fact that such a great proportion of the workingmen own their own houses. Philadelphia now has double the number of dwelling houses of any other city of its size in the world. For this the building associations must be given more credit than any other influence. There are 400 such associations in Philadelphia, and many of them have been tried for fifty years. During the worst of the panic season in 1873 some of them were compelled to close out, their members being unable to keep up their payments. The most embarrassed of them paid 93 cents on the dollar, and not one of them would have lost a dollar had they been able to hold out until a reaction had come from the fearful depreciation in real estate, on which their loans were made. A prominent Philadelphian says: 'In the riots of 1877 the 20,000 members of building associations acted as an efficient counterpoise to the lawless throngs that crowded the streets. This instinct of self-preservation, of social order, was as strong with them as with the wealthier classes, and was even more effectual. These associations have been a potent factor in making our people prosperous and moral, encouraging society and preventing dissipation.' I understand that there are 150 building associations in Chicago. They are largely taking the place of the savings banks, with greater security and profits. We cannot have too many of them."

Improved 24-Inch Pillar Shaper.

This machine is suitable for all kinds of machine and die-work, light and heavy. It has a stroke of 24 inches, cross-feed of 21 inches, and will plane a piece 18 inches in height. The box table is cast entire, including the tool shelf underneath, which makes it rigid under severe work. The cutter bar is heavy, and strongly braced by a top rib $2\frac{1}{2}$ inches thick and full height. There is space under the cutter bar for passing a shaft for cutting key-seats, or other work.

The driving shaft has outside support, taking the twisting strain from the main journals. In this new design the machine is more strongly geared, and all parts, including the crosshead, have been made heavier as compared with the company's previous machines.



Twenty-Four Inch Pillar Shaper.

The vise has steel-faced jaws, which will take in 5 inches, with graduated movement; a 12-inch vise is furnished when desired. The vise can be fastened to the side of the table when more convenient in that position. An adjustable table for taper work can be furnished.

The manufacturers of this tool are the Hendey Machine Company, Torrington, Conn.

Expansion of Dry Sand Cores and Errors in Making Core Boxes.

By Thomas D. West.

In making large core boxes few pattern makers can be found who ever make any distinction between green and dry sand cores. The core boxes for either class of cores are closely made to the size marked on the drawings, and if the cores made in them do not fit well and do not leave the "thickness" called for by the drawing, the moulder blames the pattern maker and in return the pattern maker the moulder. The latter, in trying to clear himself, measures the pattern and core boxes. The former measures nothing, but simply "sizes up" everybody, with eyes expressing indignation and regret for blunders he cannot seem to clearly lay on to any one. But the moulder has to suffer for this in having to perform labor which is not only injurious to his mould but liable to be the cause of roughness in the casting; on account of the cores or moulds surfaces having to be filed or cut off to give the thickness required.

With green sand cores, if the core box and pattern are made correctly to sizes given on drawings, they will, if there is no springing or expansion of the pattern or core box when being moulded, give the thickness called for. But with dry sand cores such cannot be expected, for the simple reason that dry sand cores will swell more or less, and the larger the cores the more they will swell. Some pattern makers have argued that the fault lies with the foundry if dry sand cores are larger than their box. Speaking upon general principles, such is not the case, for with the most intelligent management large dry sand cores will come larger than their box. In fact, even with small cores there is a swelling sufficiently large to prevent their box enclosing the cores when dry, as close as when the cores were made in them.

How much larger the cores not cracked or unduly swelled will be than the box in which they were made, mainly depends upon the character of the cores, shape, size, and sand mixture of which they are made, also a shop's facilities for properly drying them.

Cores that stand high upon their drying plates are generally found to swell more at their bottom than top; caused, of course, by the upper body weighing down the lower, and while in this case it would be more proper to say the core has sagged than swelled, it does not in any way alter the principle here advocated in allowing for expansion when making core boxes for dry sand cores.

It is not to be understood that all high standing dry sand cores having parallel sides will come larger at the bottom than top. This is greatly regulated by the stability with which the core is rodded and rammed, also the character of the sand used. Core sand mixtures that are sharp in nature will sag more than sands that have a consistency similar to loam or moulding sand.

With reference to excessive swelling of cores, there is nothing that can cause such so readily as having the sand too wet, and when drying cores, to fire too strong upon the start. Cores ever so well rodded and firmly rammed will not prevent excessive swelling when the above two evils exist; especially so when flour is used for a "binder." With rosin the results as far as the "binder" is concerned are more favorable than with flour.

Often in order to save making extra large core boxes or cores (or where other conditions will call for it), they will be made in sections of two or more pieces and then "butted" when setting them in the mould. With this class of cores the greatest trouble is generally experienced, not so much on account of the general body expansion of a core as that of surface irregularities and little swellings which generally exist, and can keep cores from jointing close by $\frac{1}{8}''$ or $\frac{3}{8}''$ or over. Of course by going over the core surfaces which are to be jointed with a file and a straight-edge, the irregularities can be removed and the surface made straight, so as to allow the cores to "butt" with a tolerably close joint, but to be thus compelled to "break the skin" of a core is something often seriously objectionable, as most moulders well know; and why so, need not be here explained. With cores of this character there should be plenty of allowance given when making their box, and in most cases it is best to give so much allowance, that, when the proper thickness is obtained when the cores are set, there must be a space between the butted surfaces sufficient to make a fin say from $\frac{1}{16}$ to $\frac{1}{8}$ of an inch thick.

Some will of course raise objections to there being any fin, but to such all that is necessary to say is, if they can make large new work cores come together and give the correct thickness without such allowance, they are an exception to the rule. It is far better that there exist a fin between butted cores, than to be compelled to break the skin of a core and thus obtain the correct thickness, not only for the sake of saving labor in setting cores, but also for the welfare of the casting. A light fin can be readily knocked off and leave a clean break or surface to the casting, whereas, as every moulder knows, to be required to break a core's skin there is not only danger of causing a fin much larger than there is any need of, but the same will be uneven and give the casting a very ugly appearance. It is of no use for any one to argue against the allowance for expansion in dry sand cores, for expansion upon general principles is bound to exist and should, as far as experience and conditions can guide, be allowed for. Just how much per square foot, as a universal rule, should be allowed for natural expansion of dry sand cores, is something that cannot be correctly given, for the reason stated in the forepart of this article, namely, that uniformity in expansion is unreliable. The nearest idea for a rule the writer can present is to state that for a casting he has lately turned out, in which there were near a dozen dry sand cores averaging 4′ square by 18″ thick, that an allowance for expansion of $\frac{1}{16}$ of an inch in the 4′ was made. These cores, it is to be understood, did in no wise "butt" against each other, and consequently had metal of about $1\frac{1}{4}''$ in thickness all around their sides. Had they "butted" the allowance for expansion would have been $\frac{1}{4}''$ instead of the $\frac{1}{16}''$ given above.

Another element not yet mentioned is that of the liability of expansion of the lumber forming the pattern and core box. When the same is dry, as is generally the case with all patterns, etc., whether old or new, the same must to some degree be affected by the damp sand with which it may be inclosed or cased. How much the expansion of the pattern will be, and where the expansion will take place, the pattern maker should be best fitted to decide. Ignoring this element, and also the former, it will be easily seen why us moulders have so much trouble with ill-fitting cores.

The purport of this article is not specially to present any rules for the allowance of expansion, but simply to evoke thought to a subject which has been too long ignored, and which, when recognized and accepted by the pattern maker, there need to be little fear but what the moulder will meet him half-way in deciding what allowance for expansion is best to adopt, and which will also conform with a shop's practical requirements in the character and conditions of a new job.

One hundred and seventy-eight steamers arrived at this port, from foreign ports, during the month of September. Of these, 108 were British, 21 German, 19 American, the remainder being of various nationalities. In the arrivals of sailing ships for the same period, this country leads Great Britain—the figures being 18 to 14—total of all nationalities 41. It is pleasing to be able to note that we "take heads" in the second class.—*Nautical Gazette.*

With Regards.

(From the National Car and Locomotive Builder for October.)

At the beginning of this month, Mr. J. G. A. Meyer goes to work on the editorial staff of the American Machinist. For the last six or eight years, Mr. Meyer has been chief draftsman of the Grant Locomotive Works, Paterson, N. J., and his name has become familiar to the engineering world through articles he has been contributing to the paper he now becomes permanently connected with, on topics relating to locomotive construction. Mr. Meyer is a clear, vigorous writer, and an engineer of wide experience. He learned the machinist trade in England, and by his own exertions acquired an excellent scientific education. On coming to America he worked for a time on marine engine work, at Chester, Pa., and at the Morgan Iron Works, New York. When General McClellan was in charge of the Department of Docks, Mr. Meyer was chief draftsman, and planned some of the most important work executed at that time. We consider the American Machinist is fortunate in securing the services of Mr. Meyer.

(From the Industrial World.)

In the last issue of the American Machinist the announcement was made that Mr. J. G. A. Meyer, author of a series of articles on "Modern Locomotive Construction," will be hereafter connected with the editorial department of that journal. He is a good writer, and will add to the interest in the Machinist.

The *National Labor Tribune* says: It is not generally known that a number of window glass workmen in Pittsburgh and other parts of the country have secured grounds and decided to build a factory in the West and run it on the co-operative plan. Yet such is the case. The plan has been under consideration for some time, and finally Des Moines, Iowa, was selected as the place most suitable for their business. Overtures were made and inducements held out by the citizens by way of encouragment, and by mutual consent a committee was sent out to investigate, arrange details and report. This was done, and so favorable was the report that a company has been organized who expect to be making window glass in their own factory one year hence. We are not advised as to what amount of cash and land has been donated by the citizens, but it is reasonable to suppose that all that could be expected has been contributed to start the concern on a good foundation. All the workmen to be employed are practical in their respective branches, and each must, under the rules, become a stockholder.

One of the most active and enterprising shipbuilders of this country was Mr. Gibbons, President of the Pusey & Jones Company, of Wilmington, Del. His decease will be widely regretted and very many will miss him. During the war he did considerable government work, and a few vessels since, but his efforts were mainly directed to building coastwise steamships. In the last twenty-five years he built more than one hundred steel and iron steamers for South America, Central America, Mexico, and the West Indies. He also built a great deal of machinery. He was a firm believer in the ability of this country to compete successfully with transatlantic countries in building modern iron vessels, and was able to demonstrate the accuracy of his belief.

Mr. Gibbons will always be remembered as a model employer of labor. Such an occurrence as a strike or lockout was almost unknown at his works.

In spite of improved draft appliances for locomotives which are now widely known and recognized, some railroads sprinkle their passengers profusely with cinders and cloud them very freely with smoke. While railroad earnings were falling off steadily there was some excuse for postponing needed alterations on locomotives, but that excuse is no longer tenable. It is of more consequence to prevent the smoke and cinder nuisance (where it exists) than to provide luxurious palace cars.

LETTERS FROM PRACTICAL MEN.

Surface Gauge.

Editor American Machinist:

I have recently devised a surface gauge which has some good points, and I should be pleased to see it placed in your museum of surface gauges.

The nut *A* is a slight improvement over the almost stereotyped form of clamp nut; although more compact and neater, it speaks for itself. The improvement, according to my estimation, is in the adjusting device at the bottom, which gives a very quick movement to the needle; ordinary gauges, with adjustment, move altogether too slow; this makes an elegant tool when properly made. Base-hardened and ground bottom connections and nut blued, it will prove a nice addition to a kit of tools; when not in use, it may be taken apart at *B*, and packed in a small space.

Lee C. Sharp.

Turning Chilled Iron.

Editor American Machinist:

Among the good things in Mr. Goodyear's letter of October 16 is his reference to turning chilled iron.

I once did a little at running such a lathe as he mentions, turning straight chilled rolls, and that experience has been of great value to me many times since.

A slow motion, a low tool and feeding straight in are methods which I have used on common lathes many a time successfully, when I have had material so hard that it could not be worked in any other way; and these methods I got from the roll lathe. It often happens that a steel set-screw blank, forged in haste, with no time for annealing, is very troublesome to turn and cut. The next time this happens with you please lower the tool a little, and note the effect. And the next time you want to get under the scale on a hard pulley, run slow, and feed in with square nose tool. For a 14″ chilled roll I used a speed of from one and a half turns a minute to one turn in two minutes, according to the hardness of the roll. For a tool I used $\frac{7}{8}$ square steel, grooved out so that the corners became cutting edges, as described by Mr. Goodyear. As to temper, I had the benefit of various bath mixtures; but I could never discover that there was anything any better than clear cold water, and then plunging again at the first show of color. The length of a roughing tool was about 2″; a finishing tool about 5″. The tools were not clamped down; they were placed in the bar rest, and as low as they would work without "hogging" in. A piece of hoop iron was placed behind the tool, and steel wedges were driven behind that, to set the tool forward; and one end or the other of the tool was pressed ahead, as the callipers indicated the need.

The cut must run itself out. It will not do to let the tool mark its stopping place; and in finishing a roll, the "needle-like chips" must be removed with a stick or brush, for one puff of the breath on the roll will make a stopping place quickly; finger marks ditto, and then perhaps the whole roll will have to be all gone over again.

The moisture causes a glaze on the surface of the roll, which can be taken out only by a heavy cut. This is why visitors, idlers and spectators in general are not welcome near the roll lathe. They cannot keep their hands off, nor resist the temptation to blow the chips away, to see the tool cut.

It is a pretty nice job to turn a roll so that no imperfection can be found by the callipers, and so that a straight edge, in a strong light, will show only the colors of the rainbow between it and the roll; yet such are the requirements of roll turning.

F. J. Masten.

Belmont, N. Y.

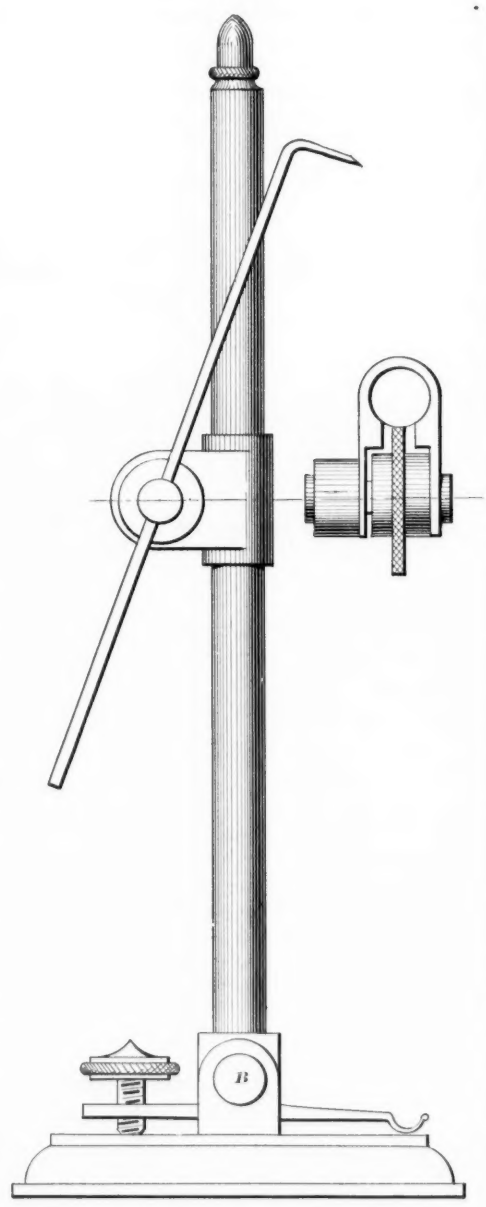
Benefits Derived from Reading Mechanical Journals.

Editor American Machinist:

In my last letter to you I told you how much I appreciated your valuable paper, and how useful I had found it on many occasions. I still look upon it as a valued friend, and must admit that it is still my best instructor.

I have just had another occasion to remember its usefulness. In this instance I had to re-tube an old boiler. Now I must say that I had done almost everything in the way of repairing boilers, both in patching, caulking, riveting and in expanding tubes; but I had never taken a tube out of a boiler, much less a whole set. A great many may think that this is not a very difficult job, and one should not allow such an easy thing to bother him. This may be true enough, if you have the tools to do it, and know just how to use them; but when you haven't them, then that's "anoder ting," as the Dutchman says. Fortunately, before I started to work at it, I took a look at an American Machinist that I had just received, and there found the very identical information that I wanted.

This was a "Report of the Master Mechanics' Committee on the Best Plan of Removing, Cleaning and Re-setting Flues." This



Surface Gauge.

is a most valuable report, and useful not only to me, but to everybody that has anything to do with steam boilers. It gives the modern practice of doing this work, not by one man alone, but by the most skillful men we have.

For removing tubes, the "Hawks-Bill Cutter, described by Mr. T. J. Hatswell, I found to be an excellent tool for cutting the tubes or flues; with this tool the work can be done quickly and without difficulty.

For re-setting the flues, I followed what I considered the best practice, as described in this report, and did the work without difficulty, and made a good job of it, every tube being perfectly tight with a cold water pressure of 125 lbs. per square inch.

Re-setting tubes or flues is a more important job than is usually supposed. I have seen this work done by ignorant, inexperienced persons, and have known the heads of the boilers to be blown out almost immediately after being used.

In a recent article, I noticed some good suggestions in regard to taking off gear wheels, pulleys, etc.

The means or ways described are good. I have proved most of them. I have also tried other ways not mentioned in this article, which may be useful to some persons.

If the machinery to be taken off be very heavy, as is sometimes the case, and the means mentioned above fail, it then becomes necessary to try something more forcible.

In such cases I usually resort to giant powder or dynamite. This method may be considered impracticable, or at least not in accordance with the best practice, but it is most effective, and if properly done works like a charm. I have used it mainly for heavy pinions and coupling, but it can be used on anything.

If it be a pinion that is to be taken off of large size, say 16″ or 18″ face by 30″ diameter, the best plan is to drill a hole down between teeth a little larger than giant powder, then take a piece about 1½″ long (for this size pinion), attach fuse, fill hole with water, then light it, and the pinion is off before you can say Jack Robinson.

The object is just to split the pinion—not to shatter it to pieces.

For large wheels and coupling it is not necessary to drill a hole. In this case it is only necessary to cut off powder the desired length, place it on the hub, cover it with clay or mud, attach fuse and light, and the job is done.

Some machinists even take or burst keys out with giant powder, but this is more liable to damage the key-seat, so I have never used it for this purpose. There are only two things to be looked out for in using powder—first, not to use too much, and, second, not to get too much of a shock on the pillow block. I usually block up or raise the pinion a little out of the bearing.

It is important to know how to take these things off, but it is far more important to know when to take them off. For instance, how many engineers know just when a gear is worn out and when it should be taken off? Very few; most of them let it run until it breaks; but this is a poor practice, as it usually breaks pinion and wheel as well.

I believe if engineers would express their opinion in regard to this matter, they would confer a favor on a great many persons.

I have often seen another trouble with machinery that is but imperfectly understood. For instance, crank-pins often wear badly on one-half, while the other half is perfectly smooth. Can any of your readers account for this?

Again I have seen slide-valves and steam-cylinders that would only work smoothly with one particular kind of oil, and another throttling engine that would only run evenly when the valve-stem stood in a certain place; if the valve got moved around only a quarter of a turn, the engine would run away.

There are a great many kinds of problems in engineering which will bother a man unless he keeps himself well posted; even then he will often find a problem to solve and difficulties to overcome that will take all of his knowledge and tax his patience to the utmost, as well as his ingenuity and ability. Often a man finds a great job on his hands, and nothing around to do it with, but still, for all that, it must be done, and quickly too.

Geo. Osborne.

Hawaii, Hawaiian Islands,
Sept. 9, 1886.

Turning Rubber Rolls in a Lathe.

Editor American Machinist:

Having seen considerable about turning down rubber rolls, leads me to give my experience. I had a job of that kind to do, not long ago. I turned the roll in a common wood-turning lathe, using a sharp gauge, doing the job without trouble. I had also to square up the ends, which I did with a sharp chisel, very easily.

N. H. Carr.

Bath, Me.

The Training of an Engineer.

At the Chicago meeting of the American Society of Mechanical Engineers there was an interesting discussion on the Training of a Dynamic Engineer, following the reading of a paper on that subject by Prof. Woodward, of St. Louis. Mr. W. F. Durfee said:

"When an engineer of experience undertakes to erect a structure or mechanism of any kind, the first thing he considers is the character of the soil upon which he is to lay those foundations, upon whose stability the integrity and usefulness of all his future work depends. In such a fundamental matter there must be no mistake; a proper selection must be made or disaster is absolutely certain.

I am a firm believer in the great possibilities and far-reaching value of the work of the leading technical schools of our land in laying the foundations upon which the practice and the fame of the engineering of the future is to rest; provided, however, that their efforts are conscientiously expended upon a wise selection of mental material.

Notwithstanding the fact that the leading schools of engineering have met with some measure of success, and that there are many members of that profession to whom they point with pride as evidences thereof, I am, as the result of a somewhat prolonged experience, firmly of the opinion that these schools will not conserve the best interests of the future, until they adopt some thoroughly effective system of selection, which shall, at an early stage of their studies, cull out from among those students who aspire ultimately to become engineers, such as have not that intuitive practical sense of the eternal fitness of things, and of the adaptation of means to ends, born in them, as an endowment of nature, which is an essential qualification of every competent engineer.

Relative to such a vital matter as this, the trumpets of our technical schools should give no uncertain sound, but should proclaim with a resonance that cannot be misunderstood, that it is not sufficient evidence of fitness for the engineering profession that a student is succesful in passing through some mere routine of study extending over a certain fixed period of time;—that there is more required than the mere facts that a young man has studied mathematics until his head is a veritable "ant-hill of units and tens;" that he has attempted to learn the mere rudiments of mechanical drawing, and next to nothing of the art of design—written a thesis upon some question affording opportunity for an exuberant display of the opulence of his knowledge of the higher calculus, which is used with such success as a foil to his abject poverty in all things practical, as to win the plaudits of his friends and the envy of his enemies:

> "And stil they gazed, and still the wonder grew,
> That one small head could carry all he knew."

More even than the culminating fact of academical experience, which much too often follows such a successful exhibition of the smooth working of the young man's memory;—that of being straightway turned loose into the work-a-day world, clad in sheepskin, "*cum maxima laude*," and decorated with some such titular abomination as "dynamic engineer."

Yes, Mr. President, something more is required than all this, to fully qualify a young man for the initial experiences of an engineer, and that something is: mental adaptation to, and an abiding love for the profession; an inborn and irresistible consciousness that in no other walk of life can he so employ the ten talents entrusted to him as to gain other ten talents, and what is of vastly more consequence, the final commendatory judgment upon his stewardship, "Well done, thou good and faithful servant."

For the purpose of exemplifying my meaning, a few illustrations from my own observation and experience may not be out of place.

Some years since I had as an assistant a young man who was a graduate of a famous European institution of learning; on his diploma were the names of some of the world's most renowned professors, who could have had no other justification for their signatures than the fact that the student, as the result of a persistent application of diligent study to a retentive memory, could "with parrot tongue, repeat the scholar's part."

This young gentleman, whose American antecedents had been reinforced by European study, and crowned with its honors, not only deliberately proposed to me, as the best possible means of determining the quality of any ore of iron and of the metal that could be produced from it, the erection of a miniature blast-furnace, ten feet in height, having all the apparatus and appurtenances peculiar to furnaces of ordinary dimensions—but he was both earnest and eloquent in support of his proposal. It is not necessary for me to say to metallurgists that there was not one grain of practical common-sense in that suggestion,

I once knew a gentleman, of excellent scholarship and admirable social qualities, who had conscientiously endeavored through all his active life to acquire business and reputation as an engineer. At the age of fifty he built a structure, which, after standing for a time, actually tumbled down from its own inherent weakness; and on investigation it was found, so imperfectly had its details been supervised, that some of its supporting columns could have been tested to absolute destruction by a tack-hammer. This gentleman had a constitutional inaptitude for the practical, although his theoretical qualifications were beyond question. I knew another man, who, after seven years' apprenticeship at the brass-worker's trade, acknowledged that he could not mould a spike.

Now, it would have been of the greatest benefit not only to these individuals, but to society at large, had some one in authority said to each of them in the outset of his career: "You are not adapted to the line of life you propose to yourself to follow." The attempt (in which far too many of our technical schools are engaged), to make engineers of anybody and everybody who, in the ardor of youthful inexperience, thinks he "wants to be an engineer," should, in the interest of society as a whole and of the future of American engineering, be stopped at once and for all time. As well think of making every man a poet who can write "doggerel," or every person a singer who has a loud voice, as to endeavor to make engineers of men whose only qualifications are perseverance and a good memory.

Before closing I desire to say a few words relative to what I will call the ethics of engineering, a subject almost if not totally ignored in our technical schools.

I have not time to discuss this important question at as great length as I desire, but will divide it into four heads and briefly speak of each.

1st. The duty which a young assistant engineer owes to his chief.

2d. The relations and duties of engineers to each other.

3d. The duty which an engineer owes to his employer.

4th. The duty which the profession owes to society at large.

As regards the first division of the subject, I will say that I have often heard it remarked by men in responsible positions that they would not have a young man from a technical school about them, as graduates from such schools had no idea of subordination or discipline, and were too much disposed to spell assistant with a big A and chief with a small c; and I have also heard of instances in which young men from some of our schools of engineering had hardly got warm in their positions as assistants to some worthy chief before they began to use all the arts of the "sapper and miner" to undermine the man whom they should have been loyally assisting, with a view of securing through the influence of relatives and friends the position he occupied.

All this is wrong, and in a great measure such conduct on the part of young engineers is the result of a thoughtless selfishness, against which they have heard no warning voice raised in the school from which they came. A young engineer accepting the position of assistant should be as loyal to his chief as the chief of staff of an army is to its general—should do everything in his power to win his confidence and to deserve it; should keep him advised of the progress of all work under his direction, and protect his reputation as carefully as his own—in short, to be an assistant, confidant and friend to his chief who appointed him.

Relative to the relations and duties of engineers to each other, much more can be said than passing time permits. Mutual helpfulness and generosity should always characterize these relations, and a charitable consideration one for another always prevail. No honorable engineer can ever do willful injustice to his fellow, or pass adverse criticism upon another's work without the fullest knowledge upon which to base it, and especially will he never comment adversely in a public manner upon the work of another upon mere *ex parte* testimony. 'Do as you would be done by,' is the rule by which every honest engineer gauges his relations with his fellows.

I must be still more brief in my comments on the third head of this subject—the duty of an engineer to his employer—and will simply say that that duty consists in the strictest honesty of word and service, and in its discharge he is to keep always in mind, to dare 'do all that may become a man.'

I now come to the fourth head—the duty which the profession owes to society. One of the first and most important duties which the profession owes to society is so to govern and conduct itself as to secure and retain the confidence of the public, to the end that when important engineering works are proposed, society will have entire faith in its judgment and unhesitatingly call for its advice and assistance. Another important duty of the profession is the maintenance of organizations for the dissemination of professional information, which tend greatly to protect society from the schemes of ignorant pretenders and unprincipled knaves. Other duties of a public character might be named if these remarks were prolonged, but I will close by earnestly urging the managers of our technical schools to bestow more attention in the future than they have in the past to the matters of discipline, and the determination of the natural qualifications of the students they graduate, and by commending the ethics of engineering to the careful and conscientious consideration of all interested in schools of engineering, and more especially to some of the more recent and enthusiastic advocates of manual training."

The First Minneapolis Industrial Exhibition which closed October 2 was a great success. The exhibition company has elected Mr. C. M. Palmer, publisher of the *Northwestern Miller*, manager for the next year, and there is no doubt that under his supervision the next exhibition will be even more successful than the one just closed.

That some should be rich, shows that others may be rich, and hence is but encouragement to industry and enterprise. Let not him who is homeless pull down the house of another, but let him labor diligently and build one for himself, thus by example assuring that his own shall be safe when built."—*Abraham Lincoln.*

Rights of Employer and Employe.

In one of our daily papers we read: Five years ago the Pennsylvania Legislature passed a law prohibiting mining and manufacturing companies from paying the wages of their employes in "store orders." The Supreme Court of that State has just set aside this enactment as unconstitutional. The court says:

"The law is an attempt by the Legislature to do what, in this country, cannot be done—that is, prevent persons from making their own contracts. The act is an infringement alike of the rights of the employer and the employe; more than this, it is an insulting attempt to put the laborer under a legislative tutelage which is not only degrading to his manhood, but subversive of his rights as a citizen of the United States. He may sell his labor for what he thinks best, whether money or goods, just as his employer may sell his iron and coal, and any and every law that proposes to prevent him from so doing is an infringement of his constitutional privileges."

That persons should be left free to make their own contracts seems to us to be a good and sound principle. But here the query arises: Would it or would it not be conducive to a better feeling and harmony between the employer and employe, if the employer would recognize and follow the principle set forth by the court, and allow the workmen to have the same privilege and liberties which the companies claim for themselves, and allow the workingmen to buy their goods where they can buy them the cheapest, and not ask the men to do that which they do not wish to do?

The coal companies are just in these times engaged in a lively and successful effort to raise the price of coal. There are some, amongst them the editor of the *World*, who are anxious to know how much of this rise in price is to go to the benefit of the miners, who work for wages about as low as it is possible to keep up the union of body and soul on. For the benefit of the *World* it may be said that nothing will go to the miner. Such a conundrum from the editor of that journal shows a lamentable ignorance of matters of this kind.

The Iron Industry in Germany.

In the *German Reichstag*, the represent a tive of the mining district of Siegen stated that it was now a question of sheer existence with the ironmasters there. Of thirty-eight furnaces, only twenty were now in blast; while of 237 mines, not more than 128 were being worked.—*Industries.*

The obsolete ironclad Resistance has been subjected to further experiments—this time with torpedoes. A 60 pound charge of gun-cotton was fired within 30 feet of the ship's side without serious effect. She was next attacked by an old 16 inch Whitehead, whilst protected by wire nets supported by 30 feet booms. The nets exploded the torpedo and the vessel remained unhurt, only one boom was unshipped and the net not extensively injured. The value of the nets having been shown, a charge of gun-cotton representing that of a Whitehead torpedo was exploded 20 feet from the vessel without inflicting perceptible damage. At 15 feet the vessel was strained and began to leak, some of the compartments being filled and water finding its way into the bilge.—*Engineering.*

A College Mechanical Department.

O. P. Hood, superintendent of the Mechanical Department of the Kansas State Agricultural College, writes us:

"I am always much interested in your remarks about industrial education, and you may be interested to know what we have out here. My department is located in a good stone building of two stories, 38x102, well ventilated, steam heated, and with power from a 10 horse-power Atlas engine. The class this year contains 153, and a few counties still to hear from. These are divided into five divisions, each division working one hour during five consecutive hours' attendance at the college.

"Thirty-three benches, with tools, are provided, and the instruction is to enable them to 'properly use and care for wood-working tools.' Even with this small allowance of time for this work—seemingly only enough to start and stop in—it is surprising what headway they will make. I found on coming here (Sept. 1, '86) that most of those in the fourth year, who had had but about fifty days of ten hours' practice, were to be trusted in most ordinary jobs, in preference to about three-fourths of the regular carpenters. I think this comes from one fact, and that is that such fellows 'think' in connection with their work, while there is a sad lack of that capacity in many of the old hands, who are continually blundering. We have no iron work at present, except 'forging' for a small class, but hope in time to give iron work its due share of attention."

AMERICAN MACHINIST

PUBLISHED WEEKLY

BY

American Machinist Publishing Co.

HORACE B. MILLER, Pres't.
JACKSON BAILEY, Vice-Pres't.
LYCURGUS B. MOORE, Treas. and Sec'y.
96 Fulton Street, New York.

JACKSON BAILEY, Editor. HORACE B. MILLER, Business Manager.

F. F. HEMENWAY, Mechanical Engineer.

The American News Company,
Publishers' Agents, New York.
The International News Company,
11 BOUVERIE STREET, Fleet Street, LONDON, ENG., will receive subscriptions for the AMERICAN MACHINIST, at 14/7 per annum, postage paid.

DEALERS SUPPLIED BY

The Albany News Company, Albany, N. Y.
The American News Company, New York, N. Y.
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The Brooklyn News Company, Brooklyn, N. Y.
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The Williamsburgh News Co., Brooklyn, E. D., N. Y.

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$2.50 a year in advance, postage prepaid in the United States and Canada.
$3.50 a year to Foreign Countries, postage prepaid.

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Transient, 35c. per line, each insertion.
"Business Specials," 50c. a line.

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NEW YORK, OCTOBER 30, 1886.

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Practical Information Utilized.

There is a wide difference between the news and literature of the daily press and that of the technical press. The former is mostly of a character to divert and entertain the reader without giving any further benefit; the latter conveys information to apply in everyday work, and is, therefore, of permanent value. Some of those who read daily papers to a great extent are inclined to regard all the matter in technical papers as merely calculated to please rather than to outline methods for practical operations.

We can assure them that this is a wrong idea, at least so far as the AMERICAN MACHINIST is concerned. Almost every day we receive letters from parties who are using successfully some of the plans and devices described in these columns. In this issue may be observed one instance in a letter from the Sandwich Islands where such information has proved valuable. We mention in these columns very few of the many instances of that kind that come to our attention, and of course we hear of but a small portion of the applications of practical information contained in the AMERICAN MACHINIST.

Incidentally we learned that the manufacturers of the white paper upon which the AMERICAN MACHINIST is printed are building (at the mill, Claremont, N. H.) a one hundred foot chimney after the design illustrated and described in our March 27th issue by William Lowe. When, as in this case, the object is plainly described, the reader can construct upon the printed information without additional particulars. It cannot be gainsaid that those who furnish practical information from their own experience, for open publication are conferring far greater public benefits than the authors of the finest essays and entertaining articles in daily newspapers and monthly magazines.

Machine Shop Graduates.

There is a great deal said and written about graduates of schools of mechanical engineering; but we don't hear much about the graduation of men from machinery establishments. Yet the latter are far more numerous than the former, and the proportion of them that are successful is as great as the former, so far as our observation extends. These shop graduates don't deliver any "commencement" orations, nor do they receive any parchment diplomas conferring degrees; but they go forth with a knowledge which is of solid, permanent value, and seldom have to unlearn what they have learned amiss. During the nine years the AMERICAN MACHINIST has been running, we have watched several of these institutions of learning (shops, we mean), and traced a number of the graduates they have sent forth. The record, if published as an "annual register," would excite the highest admiration in scholastic mechanical circles. One prominent machinery establishment in New England, for instance, has graduates in business for themselves East, West and South, building machinery, sometimes in competition with their *alma mater*. The competition, however, does not imply any jealous rivalry. The graduates usually equip their shops largely with machinery from the parent concern, and in the latter may sometimes be found, at a later date, some machines designed and built by the graduates. These beginners in business are always willing to have it known where they acquired their experience; and as they are almost always successful, the "old shop" has no reason to disown them.

Unequal Taxation.

Camden, Me., has voted to exempt from taxation for ten years the new woolen mill enterprise soon to be established. We are not informed as to any public action regarding the old woolen mill enterprise from which the town is and has been deriving a benefit. Unless that mill is also exempted from taxes for ten years an unequal competition will exist between the two Camden woolen manufacturers. Is it a just policy for the government to give one concern such a pecuniary advantage to compete with others of the same kind? We do not question either the right or the advisability of citizens of a town subscribing a bonus to bring manufacturers to the place, but when the power of taxation is exercised to exact payment from one manufacturer and to excuse another in the same business it is time to enter strong protests.

In the article in this issue relating to "Traction on Grades," by A. B. Ropes, we notice that no allowance has been made for overcoming the resistance due to the downward tendency of engine on a grade. It should also have been stated that, on very steep grades, the adhesion is proportional to the pressure of the drivers on the rails, which is less than the weight on drivers. By taking these items into account, more correct results will be obtained. Mr. Ropes' article will be read with interest, as it represents original investigations.

Our contributor F. W. Barrows asks why the pattern shop, with all its high-speed machinery, is usually placed at the top of a building. There may be a logical reason for it, and we shall be glad to hear from some of our readers who can explain it. Time-honored practice sometimes governs such matters. The cook shop of a hotel is usually located on the lower floor, and the guests whose rooms are above it, frequently get odors that are not pleasant. A new twelve-story hotel, now building in Minneapolis, will have the cooking department and the dining room on the top floor. Perhaps in a few years owners of other large hotels will wonder why they did not long ago recognize the desirability of this plan.

"Will You Walk Into My Parlor?"

The managers of a good many syndicates, banks, "investment companies" and corporations that have some very dull axes to grind seem to think the average "out of town" newspaper editor is made of very pliable material. We have before us a circular sent out by the Financier Company, 40 Broad street, New York, which reads as follows:

Dear Sir: On the 15th of November The Financier Company will establish a well regulated financial news agency, and will send out a special financial news letter to each one of its out-of-town correspondents, at $6.00 per month.

In case you should like to have us send you one of these letters, we will either take cash or its equivalent in advertising at your lowest rate. Letter to cover news up to night of mailing. The above rate will include daily or occasional telegraph matter as the news may warrant. Tolls to be paid by you.

Respectfully yours,
THE FINANCIER CO.

At the head of this unique circular is printed a list of the prominent stockholders of the Financier Company. First on the list is the President of the Western Union Telegraph Company. Then there are fourteen officers of national banks (mostly presidents), two "capitalists," the Manager of the New York Clearing House and a few others. Presumably all these men are directly interested in financial schemes which they want the public to take more interest in. Accompanying this circular is a sample copy of the "news letter" they propose to send out. We quote from it the following gems:

Southern securities are likely to have a special prominence henceforth on the New York Stock Exchange. Texas and Pacific stock represented by the reorganization trust receipts are sure to go to 25 or 30; the same stock lately was pushing around neglected down below 10.

* * * * *

The stocks of the Cincinnati, Indianapolis, St. Louis & Chicago Road (known as the "Big Four") is to go up to something like 108 or 112 before long. It is now dull and neglected at a point or two below par. Insiders are preparing a "program" which will kite it.

This is the kind of "news" that "out of town" papers are invited to pay $6.00 a month for. Any of them that publish it ought to be paid liberally for doing so.

For downright concentrated quintessence of cheek this scheme surpasses anything else we have seen offered to newspapers.

Building Associations and Savings Banks.

On another page we publish a clipping from the Chicago *Herald* in which a manufacturer gives his views about building associations. He mentions that Philadelphia, which is pre-eminently a city of homes, has four hundred such associations and that many of them have been tried for fifty years. Chicago has about one hundred and fifty such associations, and he mentions that "they are largely taking the place of savings banks, with greater security and profits." They are better than savings banks in several particulars. Workmen who place their surplus earnings in building associations have thereby an opportunity to learn something about business, but who ever heard of any one learning anything about business by being a depositor in a savings bank? The managers of those banks generally assume that depositors do not even know how to fill out a check, and make it a regular practice to do it for them, whether requested or not.

In seasons of great financial stress all institutions are well tried. The manufacturer above quoted calls attention to the most embarrassed building associations in Philadelphia paid 93 cents on the dollar in the panic of 1873, and none of them would have lost a dollar if they had had means to hold out until a reaction came. How was it with embarrassed savings banks in that crisis? None of them paid 93 cents on a dollar and the depositors were often fortunate to get nine cents on a dollar. In one year savings banks failed in the State of New York owing depositors nearly fifteen million dollars. By far the greater part of this money was utterly lost.

Owners of real estate are especially interested in good, economical government, which means low taxes and a check to every plan for extravagance with public money. Employers cannot do better than to encourage workmen to form building associations, and as a general plan for depositing their savings we know of nothing better for the workmen to adopt.

A correspondent writes as follows: "Will you inform me what kind of cement to use to fasten cloth $\frac{1}{8}$ inch thick to cast-iron rollers 6 inches diameter and 30 inches long? A roller 3 inches diameter, heated with steam, runs between the two 6 inch rollers, and comes between, and comes in contact with the cloth with great pressure. I have tried fish glue, but it cracks and the cloth becomes loose when the pressure is applied."

We trust that some of our readers, who have had experience with such matters, will be able to help our correspondent in this matter. It is not easy of accomplishment.

Literary Notes.

TREATISE ON THE THEORY OF THE CONSTRUCTION of Helicoidal Oblique Arches. By John L. Culley, C.E. D. Van Nostrand, publisher, 23 Murray and 27 Warren streets, New York.

This is one of Van Nostrand Science Series, that sells at the low price of 50 cents. We should suppose, from a cursory examination, that it was worth several times the price asked to those engaged in work of the kind treated of.

SUPPLEMENT TO THE STEAM ENGINE CATECHISM. A Series of Direct Practical Answers to Direct Practical Questions, mainly for the use of Young Engineers, and for Examination Purposes. By Robert Grimshaw, M. E., etc. New York: John Wiley & Sons. Price $1.

We cannot better explain the scope of this work than to quote from the author's preface:

"The matter in this volume is intended as supplementary to the Catechism, and needs no excuse for its appearance.

"The extreme popularity and rapid sale of the Catechism proper warrant the author in putting in the same form additional material of the same general character.

"This volume contains the answers to many questions which were asked by engineers and steam users, and the answers to which do not appear in the Catechism itself,

"It refers in many places to the Catechism, and is intended to be used with it.

"Particular attention is paid to compound engines, to link motions, to the details of various existing types of steam engines, and to matters concerning setting up, running, adjusting, repairing, and altering particular builds of engines."

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials nor location will be published.

(377) C. G., Paterson, N. J., asks: What numbers of the AMERICAN MACHINIST contain drawings of a steam engine by Mr. Hoffman? *A.*—January 3 and 10, June 12 and 19, July 10 and 17, and September 11 and October 2 and 9, 1880.

(378) W. U., Philadelphia, Pa., writes: We are using in the machine works knit cotton wipers in place of waste. How can we clean these wipers so as to use again? *A.*—You can probably clean them by boiling in a strong solution of common soda and water.

(379) B. C., Chicago, Ill., asks: How is soda water, used for screw-cutting and other purposes, made? *A.*—By dissolving common soda in water. There is no rule for the exact quantity to be used. Your judgment will be sufficient. We do not know of any work devoted to screw tools and screw-cutting.

(380) J. A. K. asks: 1. If the pressure per square inch of piston is 60 pounds in an engine developing 125 horse-power, can the pressure per square inch be reduced by throttling? *A.*—It can. 2. What will be the power of this engine when the pressure is reduced by throttling? *A.*—In this case the power of the eng ne cannot be estimated without an indicator card taken under these conditions.

(381) Keystone writes: We have on hand a large lot of brass chips, free from iron, but it is dirty from walking, and gets the benefit of all dust in the shop. What can we put in the crucible to clean it when melting? *A.*—Sift the chips as thoroughly as possible by a fine sieve before the chips are placed in the crucible to melt. Any dust or dirt which might have remained among the chips after sifting, and which would have an injurious effect, will float on top of the melted metal, and is taken off when the liquid metal is skimmed.

(382) C. H. B. asks: What is the best way to bore tapered and cut threads in a tapered hole, with a common engine lathe without the "taper attachment?" The taper being 1" in 3', the threads to be cut in the boxes or sockets are used to connect the drill in drilling oil wells *A.*—The tapered ends could be turned and threaded by moving the tail-stock out of center. But for boring and tapping a tapered hole having so great a taper as 1" in 3", we believe that a taper attachment is almost indispensable. Without such an attachment the hole might be tapered with suitable reamers, and tapped with a number of suitable taps. But this method of doing the work would be expensive and unprofitable.

(383) C. L., Erie, Pa., writes: In *Haswell* there is a table of the velocity of the flow of steam into the atmosphere per second. The velocity at 5 lbs. pressure is given as 973 feet, and at 100 lbs. 1,957 feet. Will you tell me why at twenty times the pressure the velocity is only doubled? *A.*—The velocity is not as the pressure, but is referred to the action of gravity. To compute the velocity, you find the height of a column of steam that would produce the pressure noted; in other words, the height of a column of steam one inch square that will weigh the same as the pressure noted. Then the velocity will be the same as that of a body falling from that height. The velocity which a body falling freely by gravity will attain is found by multiplying the square root of the height by 8.03.

(384) J. G. B., Elizabeth, N. J., asks if there is a paper devoted to brick-making or any concern near by making hand or horse-power brick machines? *A.*—The *Brick, Tile and Metal Review*, of Pittsburgh, and the *Clay Worker*, of Indianapolis, represent the brick industry. Hand and power machines will probably be found advertised in their columns.

(385) J. T. S. writes: 1. I am running a Corliss engine, 12"x36", having a 12-foot fly-wheel, making 65 revolutions per minute, with 70 pounds boiler pressure. We have two rock mills to run. The engine will run one mill and cut off with 48 pounds of steam, but will hardly cut off with both mills. Now we want to run both mills; we cannot carry any more pressure on our boilers. Will the engine do the work if we speed it up to 80 revolutions per minute, and how much power can we gain by so doing? *A.*—You will gain about 23 per cent. But whether you can or cannot speed the engine to 80 revolutions per minute will depend upon the steaming capacity of your boiler. From the data received, it is impossible to determine that by speeding the engine up to 80 revolutions would give you sufficient power to run both mills? 2. How can I find the area of a circle? *A.*—Multiply the square of the diameter by the decimal .7854; the product will be the area required.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Patent Att'y, H. W. T. Jenner, Washington, D. C.

J. Clayton, Air Compressors, Rock Drills, 43 Dey st, NY

Edw. Sears, Wood Engraver, 169 William st., N.Y.

Steel Name Stamps, etc. J. B. Roney, Lynn, Mass.

Selden Packing, for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., NY

The Best Upright Hammers run by belt are made by W. P. Duncan & Co., Bellefonte, Pa.

Light articles built to order by the American Sewing Machine Co., Philadelphia, Pa.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts., New York.

20", 25," 28" B.G. and S. F. upright drills for immediate delivery. Currier & Snyder, Worcester, Mass.

The best wire nail and tack and nail machinery. Wm. A. Sweetser, Brockton, Mass.

Ice and Refrigerating Machines. 120 built, and all successful, by David Boyle, 521 Monroe, Chicago, Ill.

20,000 addresses of steam users and users of mach. in 10 States, $10. J. N. Mills Pub. Co., 30 Vesey st., N.Y.

"How to Keep Boilers Clean." A book mailed free, by James E. Hotchkiss, 93 John st., N. Y.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocum & Son's Shafting Works, Drinker st., Philadelphia, Pa.

Complete sets of Castings for making small and medium-sized Vertical Engines; send for prices. Humphrey's Foundry, Bellefontaine, O.

For Best Return Steam Traps, Pressure Regulators, Positive-Acting Pump Govs., Back-Pressure Valves. T. Kieley, 11 W. 13th st., N.Y. Send for des'n.

Curtis Pressure Regulators, Curtis Return Trap. Curtis Damper Regulator. See Oct. 2, p. 15. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.

Engine Lathes, Hand Lathes, and other fine tools, Assortment large; prices low. Frasse & Co., 62 Chatham st., N. Y.

Machinists' supplies, brass goods m'f'rs supplies, polishing materials, all kinds wire, metals, etc; in any quantity. Jordan & Gottfried, 208 Canal st., N.Y.

Draftsman's Adjustable Curve Ruler; makes any curve; sold everywhere F. W. Davenport, Mfr., Providence, R. I. Circulars gratis.

Wanted—Good man in every shop in the Sonth and West to sell Tools. Samples free, C. H. Besly & Co., 175 and 177 Lake st., Chicago, Ill.

St. John Improved Self-adjusting Cylinder Packing, for marine and stationary engines and locomotives; applicable to water, air, oil and ammonia pumps. For durability and minimum of friction, it is unexcelled. Send for pamphlet. Address, Balance Valve and Piston Packing Co., room 58, 280 Broadway, New York.

Patent Binders for the AMERICAN MACHINIST, holding a complete volume (52 issues), simple, neat, durable. Price $1, prepaid, to any part of the United States by mail. To Canada or foreign countries the price will be 75c.; purchasers pay express charges and customs duties. AM. MACHINIST PUB'G CO., 96 Fulton st., N. Y.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines, and current practice in testing engines and boilers. Price, $2 post-paid. Published by John Wiley & Sons, 15 Astor Place, New York.

MANUFACTURES.

John Goode is erecting a rope factory, 200x60, at Ravenswood, N. Y.

Greene & Moulton, machinists at Malden, Mass., are succeeded by Greene & Chaney.

An addition, 80x64, is to be built to the foundry of Whitehill & Smith, at Newburgh, N. Y.

A. H. Osborn, Parkersburg, W. Va., is laying the foundation for machine shops

It is reported that L. W. & J. H. Mann will start a machine shop at Ocala, Fla.

The Ashland Coal and Iron Railway Company, Ashland, Ky., will erect an iron furnace.

Williams & Briggs, Meridian, Miss., will enlarge their foundry and machine shop.

G. B. Rogers, Denison, Texas, will rebuild his foundry and machine shop, recently burned.

The Grone Brewery Company will erecta $22,000 brewery in Reading, Pa.

J. S. & J. K. Crawford, Philadelphia, Pa., have the contract to erect a knitting factory at Millheim, Pa.

The Richmond and Allegheny Railroad Company will erect large engine-house and machine shops at Clifton Forge, Va.

An addition is to be built to the shoe factory at Portsmouth, N. H. The new building will be 135x53, six stories high.

Caribou, Me., wants a foundry and machine shop, and will exempt it from taxation, so far as it can legally be done.

The Union Switch and Signal Company, of Pittsburgh, will erect an addition to their works, to employ 300 more men.

The Wilkesbarre Axle Works, Wilkesbarre, Pa., will be ready for business about the 1st of October, and will require about 1,000 hands.

Work has just been commenced on a new foundry and machine shop at White Pigeon, Mich. H. L. Chapman is interested.

The Warwick Machine Company, Warwick, N. Y., are negotiating for the purchase of the Randall steam mills

The Knights of Labor, Amsterdam, N. Y., will form a co-operative company for the purpose of manufacturing brooms.

M. E. Brown & Co., of Syracuse, N. Y., have purchased property at Clayville, and will move their carriage manufactory to that place.

It is reported that the Knoblaugh & George Furniture Company, Eighth street, above Evans, Cincinnati, will move to Birmingham, Ala.

It is rumored that J. C. Smith & Bro., Tuskegee, Ala., will build an oil mill and furniture factory at Lafayette.

The stockholders of the Huntsville Cotton Mills Company, Huntsville, Ala., will issue bonds to the amount of $50,000 for the purpose of doubling their present capacity.

The Watson Iron Works Company, of Bridgeport, Conn., has been incorporated. Capital stock, $12,000. Jas. Watson, Samuel T. Rogers and James Watson, Jr., corporators.

James Baillie Hamilton, the inventor of the "vocalion," will have the chief factory for the manufacture of his instruments at Worcester, Mass.

The Talcott foundry at Brightwood, near Springfield, has been purchased by John McFethries and Wm. C. Lawton, of Springfield, Mass., for about $16,000.

The works of the Convers Toy and Woodware Company, Winchendon, Mass., are to be enlarged by the erection of a four-story building, 40x100 feet.

The Bohn Manufacturing Company, St. Paul, Minn., will erect a three-story brick addition to factory, 177x160 feet, to cost $45,000. They manufacture sash doors, blinds and mouldings.

The Lawrence Machine Company, of Lawrence, Mass., formerly Lawrence Machine Works, has been incorporated. Capital stock, $50,000. Joseph B. Battles, Alfred A. Brooks and Wm. O. Webber, corporators.

The E. J. Manville Machine Company, of Waterbury, Conn., has been incorporated. Capital stock, $25,000. E. J. Manville, R. C. Manville, Frank B. Manville, Fred. J. Manville, W. W. Manville and G. H. Manville, corporators.

The name of the stock company recently reported to be organized at Staunton, Va., to establish a foundry and machine shop, is the Augusta Agricultural Works. The capital stock will be $8,000.—*Baltimore Manufacturers' Record.*

Sonbrook & Baker, of Labargo, Mich., are building an addition to their flouring mill to be used as a cider mill. If the demand for something to drink shall exceed that for something to eat, they will be in position to take advantage of it.

The Putnam Woolen Company, of Putnam, Conn., employing 400 hands, have voluntarily reduced the hours of labor from 12 to 10½ per day, and have just had 300 electric lights placed in the mill.

The Garfield Injector Company, of Wadsworth, O., formerly doing business under the same title, has been incorporated. Capital stock, $30,000. Jacob Detweiler, E. J. Young, Frank W. Kremer, Jacob S. Oberhotze and B. F. Sonnaustine, corporators.

Wm. Tod & Co., Youngstown, O., write us: "Your Ohio correspondent, who 'writes about process of making shafting by cold drawing,' may have referred to Mahoning Valley Iron Company, of this place, who are owners of the 'Acme' cold drawn shafting, and who would answer all questions.

The Chandler & Silver Water Motor Company, of Boston, have issued a new descriptive catalogue and price-list of their water motor. These motors are made from one to twelve horse-power, and have proved themselves very durable and economical. Testimonials are published to show how well they work.

Wm. H. Warren, Worcester, Mass., writes us: "I am very busy, having more orders on special machines than I have had at any time for years. One of the special tools is a four-spindle, adjustable drill for valve work—an entirely new feature. Have also one of my largest radial drills ready to ship to Wm. Gleason, Rochester, N. Y."

The *Industrial World*, of Chicago, says: "Information comes from Bridgeport, Conn., that the Howe Sewing Machine Company intends to move its factory from that city to this. The plant in Bridgeport cost $500,000. The cities of Cincinnati and Cleveland have each offered inducements for the removal of the establishment thither, but apparently the change decided upon is as above indicated."

The Todd Pulley and Shafting Works, St. Louis, Mo., send us a pamphlet price-list of their machine-moulded pulleys. It contains cuts and a telegraphic cipher code, but we do not find a date upon it. Enclosed with the price-list is a circular dated September 20, 1886, announcing the completion of large foundries, machine shops and pattern shops, which are opened for business.

The Co-operative Foundry Company, of Rochester, N. Y., have the foundation laid and are pushing the construction of an extensive brick foundry and shops, on the line of the Central Railroad about two miles from the city. The arrangement will be very convenient, and the equipment complete in every detail. The company expect to occupy the new buildings by January 1.

Jones & Hitchings, the enterprising Portland (Me.) machinists, will remove the first of next month to the Mussey Block, on Fore street, where they will occupy five floors, and have greatly enlarged facilities for their business. They will put in new engines and boilers, and be fully prepared to meet the growing demands which their numerous customers are making on them.—*Industrial Journal.*

The Pratt Coal and Iron Company, Birmingham, Ala., and the Tennessee Coal, Iron and Railroad Company, Nashville, Tenn., have consolidated, with a capital stock of about $10,000,000. The new company will build one iron furnace in addition to the four previously reported to be erected by the Pratt Coal and Iron Company, and the one at South Pittsburgh, Tenn., by the Tennessee Coal, Iron and Railroad Company. Basic steel works are to be erected.

The Doty Manufacturing Company, of Janesville, Wis., have issued an illustrated catalogue and price-list of their hand and belt-power punching and shearing machinery and boiler makers' rolls. They say: "Eighteen years' experience enables us to furnish reliable machines adapted to all classes of work. We have made many recent improvements." We suggest that another improvement would be to date the issue of the catalogue. It may be ten years old, though we have just received it by mail.

As an indication of the improvement of business throughout the country, the city of Erie, Pa., is engaged in more buildings than at any other time in its history, there being a number of large buildings erecting for manufacturing purposes. Among others is the Ball Engine Company, who expect this month to get into their new and commodious buildings. This firm has been running night and day all this year to keep up with their orders, and have lost many on account of not being able to ship promptly.

Between the 1st of September and the 8th of October, 1886, the Pratt & Whitney Company, of Hartford, Conn., entered orders for 1 metal band saw, 1 screw heading machine, 2 drop hammers, 1 shaper, 4 planers, 15 milling machines, 16 drilling machines, 18 lathes, 25 hand operating and automatic screw machines, 10 machines for special work on sewing machines, 18 combination lathe chucks, and taps, reamers and gauges in unusual quantity. A few of the orders were from abroad, but they were mainly from New England, Middle and Western States.

Sterling Elliott, of Newton, Mass., has designed a tricycle upon an entirely different plan from any now extant. The wheels are of tough wood—the large ones 36 and the small one 20 inches diameter. The tire is of steel and leather. The machine has been tried and pronounced first-class. The Sterling Cycle Company has been organized to make and sell the machine. Officers are: President, Elliot C. Lee; secretary, Abbot Bassett; treasurer, Chas. A. Holmes; mechanical engineer, Sterling Elliott, of Newton; directors, the above-named gentlemen, together with George D. Gideon, of Philadelphia, and Chas. H. Potter, of Cleveland. In order to meet the demands of manufacture, Mr. Elliott is having a two-story addition made to his factory, Maple street, Newton. The office is at 194 Washington street, Boston.

Amesbury, Mass., will build about 30,000 carriages the present year and about 3,000 sleighs. Business is good, and several carriage factory buildings are being erected. Most of the work of building a carriage is "let out;" for instance, a gang of men will take for a given price twenty-five or thirty bodies of a given pattern; another lot of men will work on as many seats, or such a part of the running gear. Only one part is often worked upon by the same men. When the carriage is completed, it is "knocked down"—the wheels are secured in a rack while the bodies are packed securely in the car for transit, an ordinary car holding a large number of carriages. Only two or three firms do much in sleighs. The winter's snows are of such uncertain duration that the manufacture of sleighs is attended with considerable risk. Last year about 5,000 were sold.—*Boston Commercial Bulletin.*

The Yale & Towne Manufacturing Company Stamford, Conn., has issued a very complete and artistic "Album of Crane Designs." The name might lead to the belief that this volume was of unwieldy size. On the contrary, it is not too large for the pocket. It contains a large number of illustrations; in fact, a variety far greater than we supposed were made by any concern in the country. The use of cranes and similar appliances has heretofore received, in this country, but a small part of the attention due the subject, and we think the Yale & Towne Company are, in the issuing of this work, deserving of credit for furnishing information in so convenient form. Every mechanical engineer should have a copy of this work, and it should be in the office of every shop in the country where heavy material is to be handled. The illustrations will show, in many instances, what a simple matter it is to adopt one of the many systems to save labor and expedite work. Contractors and those engaged in any kind of outside work, where material must be handled, will be equally interested in this book.

Machinists' Supplies and Iron.

NEW YORK, Oct. 15, 1886.

Iron—Furnaces are sold up close to capacity, and buyers are not disposed to contract ahead for large supplies. No. 1 X Foundry sells at $18.50 to $19.50 the highest price being for special brands; No. 2 X, $17.50, and Grey Forge, $16 to $16.50. Scotch pig is held firm, at $21.50 to $22 for Coltness; $19.50 to $20 for Glengarnock; $19 to $19.25 for Eglinton.

Lead is dull and heavy, at 4.35c. for Western, and 4.45c. to $4.50c. for foreign.

Copper—Lake is firmly held, at 11¾c. to 11⅝c.; other brands at 10¾c. to 10¾c.

Tin—Banca jobs at 22c.; Straits and Malacca, 22.5c. to 22.6c.; Australian, 22.5c.; and L. & F., 22⅞c.

Spelter—Western is dull, at 0 . to 4.60c.; and Silesian, 4.70c. to 4.75c.

Antimony—Hallett's, 7.55c. to 7.60c.; and Cookson's, 8.90c. to 9c.

✲WANTED✲

"Situation and Help" Advertisements only inserted under this head. Rate, 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Wanted—Foreman of machine shop. Address, with wages, etc., BOX 6, AM. MACHINIST.

Graduate of Sheffield Scientific School, with some experience in drafting room, desires situation. Address D. J. Kelsey, Killingworth, Conn.

The undersigned would like to correspond with parties who may be in want of a man who is capable of doing fine and close work; is now foreman of a Canadian manufactory (been 14 years in present position), but his ambition is to advance to a more advantageous position. Address M. M., AM. MACHINIST.

A mechanical engineer, who is an able designer and draftsman and practical workman, and who has been accustomed to manage men, make out estimates and sales, wishes an engagement with a good firm; has had much experience with the Corliss engine, condensing and compound engines; also agricultural engines and general machinery. Address A. C. D., AM. MACHINIST.

Wanted—Foreman for machine tool department of a large stationary and portable engine works; must be a draftsman and familiar with valve movements and high-speed automatic engine work; must understand handling men; to the right person there is an opportunity to secure the position of superintendent of the establishment. Address, stating age, T. E. J., AM. MACHINIST.

✢ MISCELLANEOUS WANTS. ✢

Advertisements will be inserted under this head at 25 cents per line, each insertion.

The Cyclone Steam Flue Cleaner is king, and has no rival. Crescent Mfg. Co., Cleveland, Ohio.

Crescent Boiler Compound has been used 40 years and still the best. Crescent Mfg. Co., Cleveland, Ohio.

Light mach'y of all kinds built at short notice. Edmund Mills, 8 Dey st., Jersey City Heights, N. J.

Wanted—Address of parties that will contract to make articles in iron, weighing from 40 to 50 lbs. Address Vises, AM. MACHINIST.

Wanted—To rent, with a view to buy, a small machine shop, with or without foundry. Address Machine Shop, AM. MACHINIST.

Wanted—A grinding lathe; state accurately the guaranteed condition; also maker, how long used, size and price. Address B., AM. MACHINIST.

The best engines and boilers, ⅛ to 4 H.P.; economical in price, steam, etc. Washburn Engine Co., Medina, Ohio.

John Lamberty, mfr. telegraph and electrical instruments, experimental machs, models; fine gear cutting a specialty. 35 S. 5th st., Br'kl'n, E. D., N. Y.

Special tools and machines for mfg. designed and built to order; mechanical and Patent Office drawings. Weston & Smith, Syracuse, N. Y.

Wanted—Correspondence with party having marine railway to disposeof, by the K. of L. Boiler, Machine & Repair Co. Parke L. Poindexter, Sec'y, Norfolk, Va.

Wanted—A first-class cotton and woolen shuttle maker as partner; a good opportunity for a man (who understands the business) with a small capital. Address Box 4, AM. MACHINIST.

Experimental and new machinery for special purposes built by contract from specifications and inventors' designs; ample facilities. Cohoes Iron Foundry and Machine Co., Cohoes, N. Y.

For Sale—One 30 H. P. Fire-Box Boiler, good as new, $375; one Strange Automatic Barrel Stave Saw Mill, used but a short time; also a number of Portable and other Engines and Boilers. Address Ezra F. Landis, Lancaster, Pa.

For Sale—A well established foundry and machine shop, including lots, buildings, machinery, patterns, and stock on hand, situated in Logan, Hocking Co., Ohio; will sell on easy and satisfactory terms; reason for selling—old age and ill health. Apply to R. Belt, Logan, Ohio.

Important sale of valuable machinery at the Howe Machine Co.'s Factory, Bridgeport, Conn., consisting of milling machines, automatic screw machines, hand screw machines, drill presses, tapping machines, cam machines, lathes, planers, etc. Send for catalogues to E. Parmly, Agent, Bridgeport, Conn.

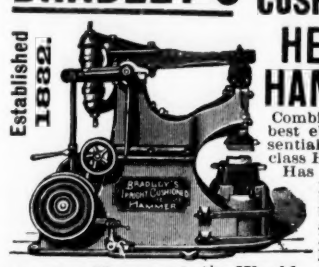
✢ MISCELLANEOUS WANTS. ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion.

For Sale—The machinery, tools, plating apparatus and raw material of manufacturing establishment; now working on orders in brass and other metals; very low rent, including steam power. Address Manfr., P.O. Box, 285, New Brunswick, N.J.

For Sale—A first-class foundry and machine shop; large connection in saw-mill county in the South, including buildings, lots, machinery, and mills' supply stock on hand; business will be carried on until sold; reason for selling, retiring from business; apply at or address Southern Foundry, AM. MACHINIST.

BRADLEY'S UPRIGHT CUSHIONED HELVE HAMMER



Combines all the best elements essential in a first-class Hammer. Has more good points, does more and better work and costs less for repairs than any other **Hammer** in the **World.**

BRADLEY & CO. Syracuse, N.Y.

BEAUDRY'S ✢ UPRIGHT CUSHIONED POWER HAMMER

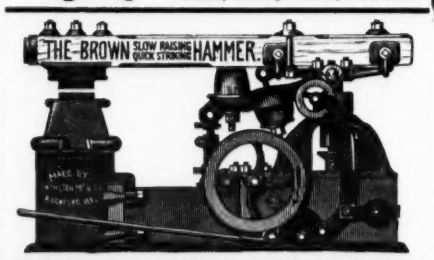
The success of our machine is the best proof of its value. Is more like a steam-hammer than any other, yet has all the economic advantages of a power hammer, and is far superior to any. Will work a larger bar of steel or iron and turn out more difficult forgings than any other hammer made. **Guaranteed as represented, or no sale.**

BEAUDRY & CUNNINGHAM, Boston, Mass.

STEPHENS PATENT VISES.

50 PER CENT. OF time and labor saved by using this solid, strong, durable, quick-working Vise. Has the Improved Taper, Pipe and other attachments. Sold by the trade. Send for circular

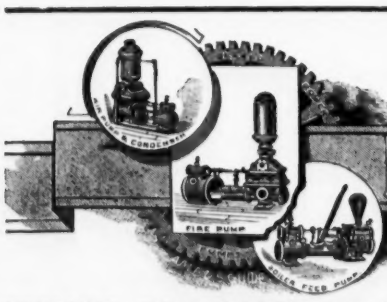
MELVIN STEPHENS, Prop'r.
Office, 41 Dey Street, New York.



THE BROWN HAMMER
STRIKES A BLOW WITH
Double the Velocity That it Raises the Hammer.
A NEW MOVEMENT! SEND FOR DESCRIPTION.
Knowlton Mfg. Co., King St., Rockford, Ill.

WANTED--FIRMS
Who deal in fixtures necessary for the manufacture of
Conic Pressed Wooden Bungs.
Address offers to H., 24,747, care
HAASENSTEIN & VOGLER, Hamburg, Ger.

KNOWLES Steam Pump Works.



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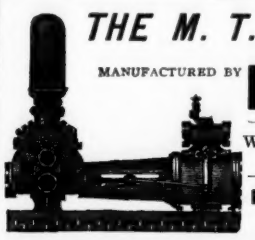
IMPROVED PUMPING MACHINERY For Every Class of Work | SEND FOR NEW ILLUSTRATED CATALOGUE.

THE DEANE STEAM PUMP CO., HOLYOKE, MASS.

BUILD WATER WORKS, ENGINES AND STEAM PUMPING MACHINERY.

Send for Catalogue No. 18.

THE M. T. DAVIDSON IMPROVED STEAM PUMP,



MANUFACTURED BY **DAVIDSON STEAM PUMP COMPANY.**

WARRANTED THE BEST PUMP MADE FOR ALL SITUATIONS.

PRINCIPAL OFFICE, No. 77 LIBERTY STREET, N. Y.
NEW ENGLAND OFFICE, 51 OLIVER STREET, BOSTON, MASS.

THE HENDEY MACHINE COMPANY. MANUFACTURERS OF TORRINGTON, CT. Machinists' Tools, LATHES, PLANERS, SHAPERS, DRILLS, ETC., ETC. *SEND FOR CATALOGUE*

THE WESTINGHOUSE MACHINE CO.

OF PITTSBURGH, MANUFACTURERS OF
The WESTINGHOUSE AUTOMATIC ENGINE,
NOW PLACE UPON THE MARKET,

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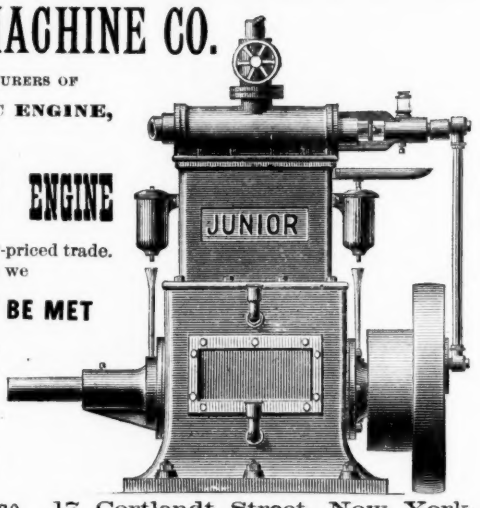

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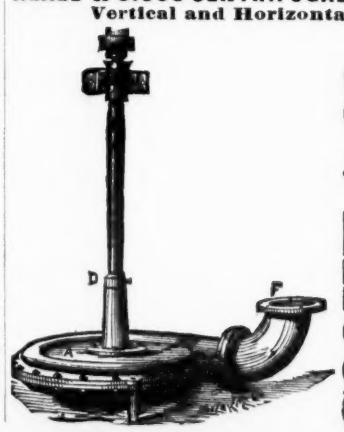

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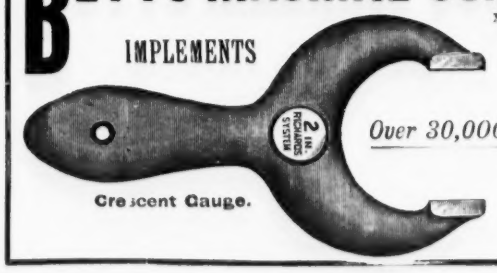

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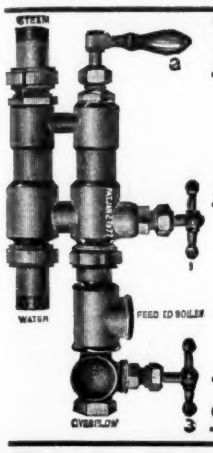

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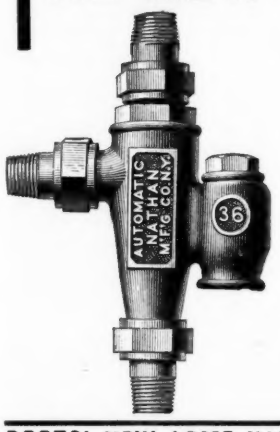

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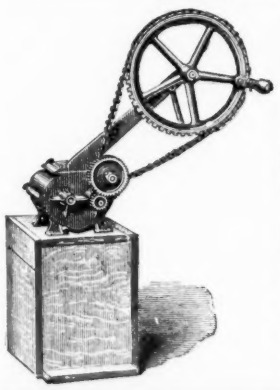

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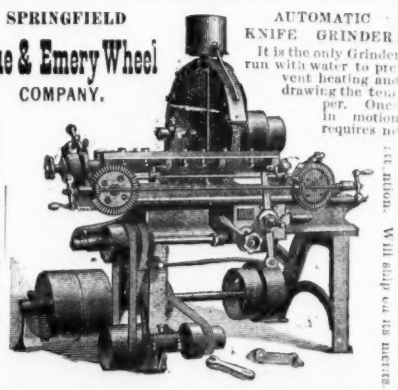

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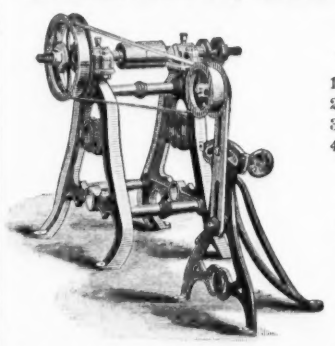

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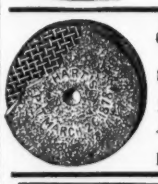

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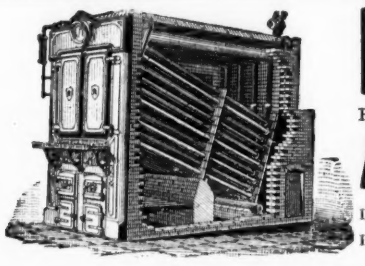

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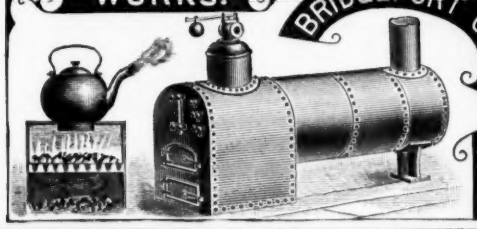

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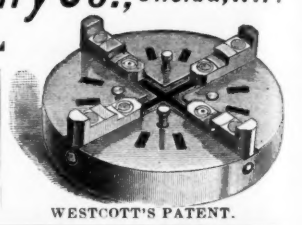

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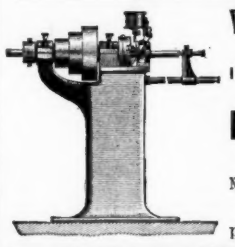

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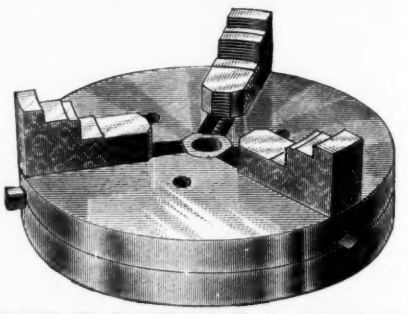

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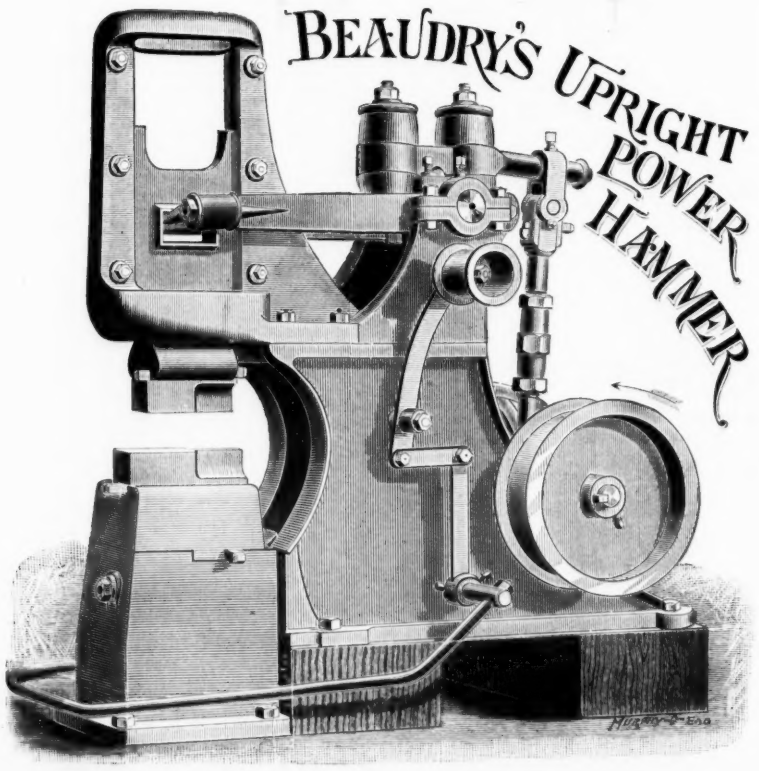

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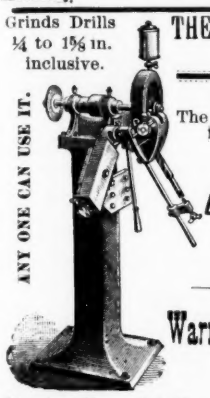

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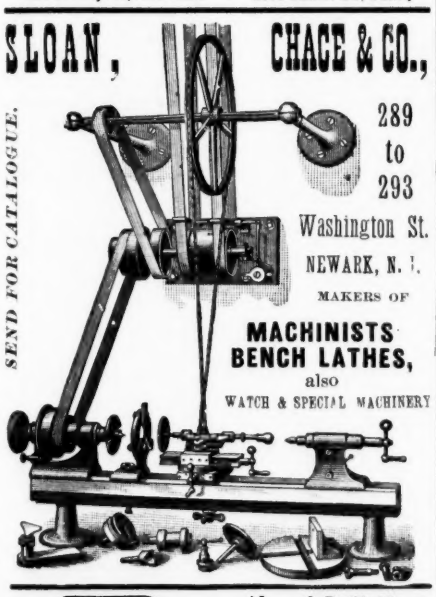

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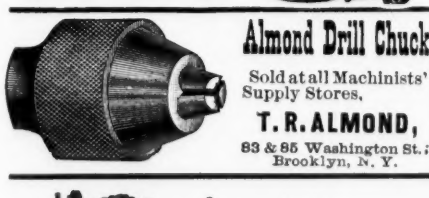

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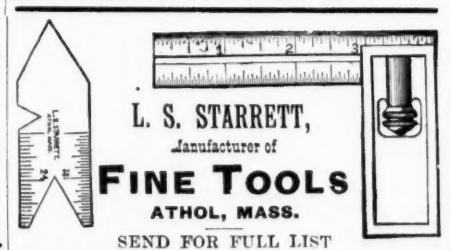

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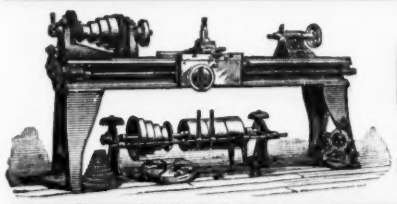

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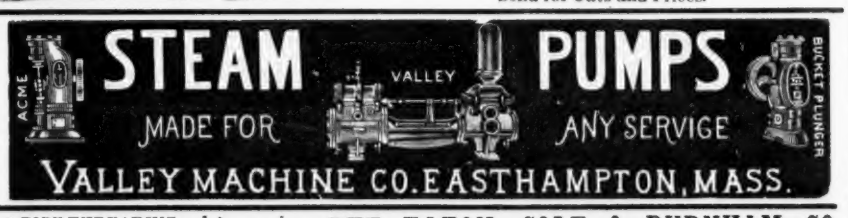

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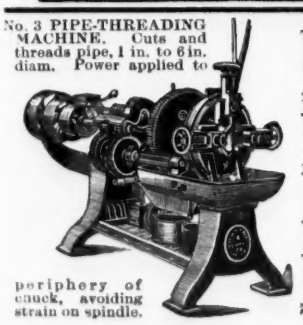

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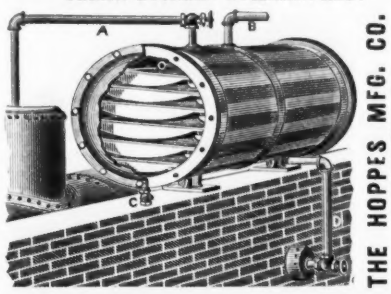

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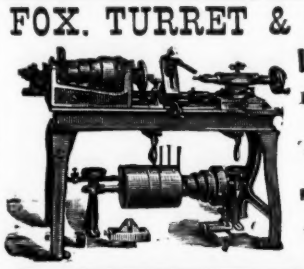

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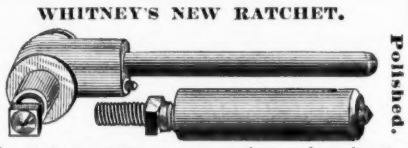

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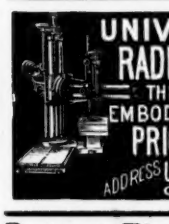

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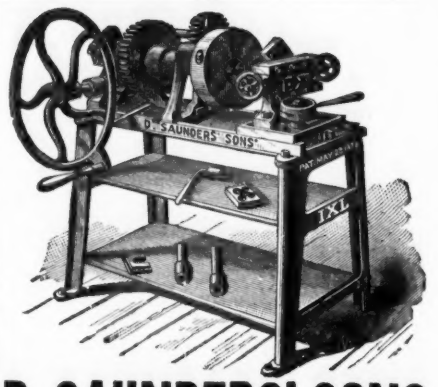

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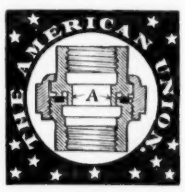

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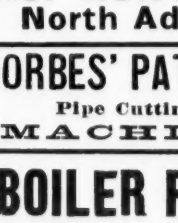

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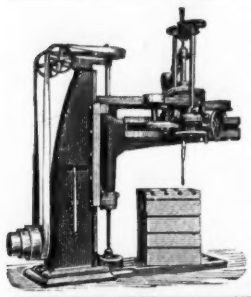

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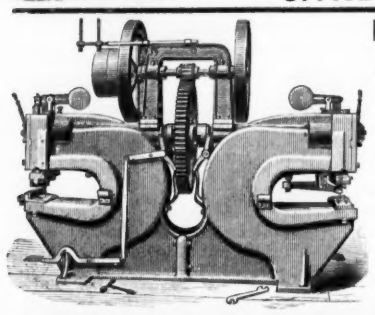

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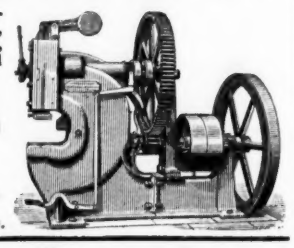

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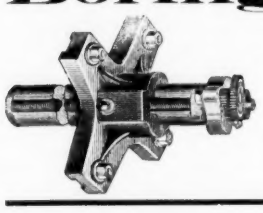

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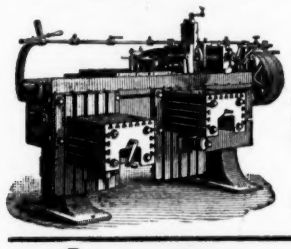

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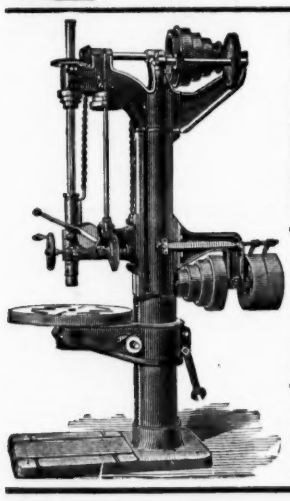

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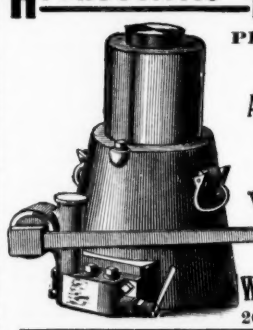

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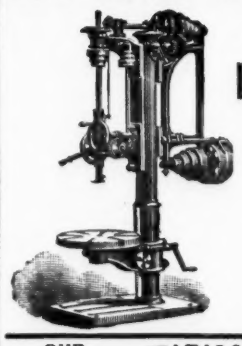

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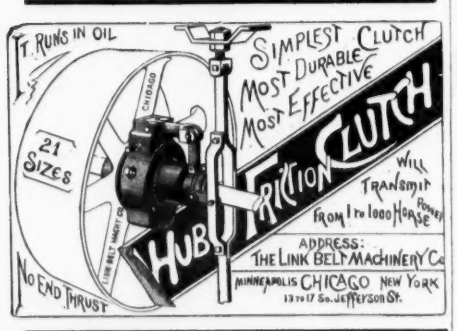

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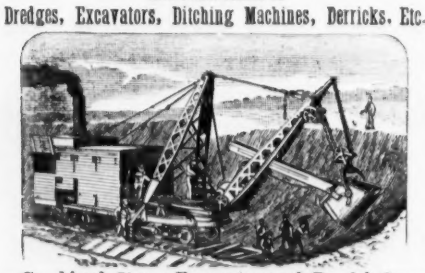

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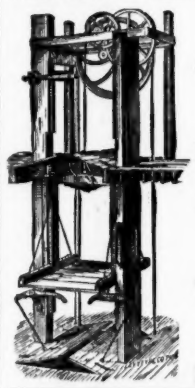

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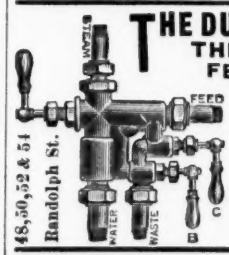

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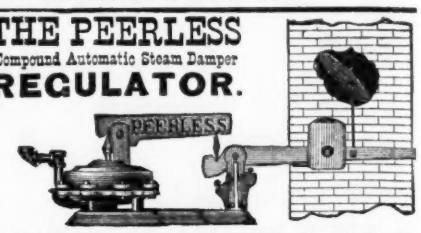

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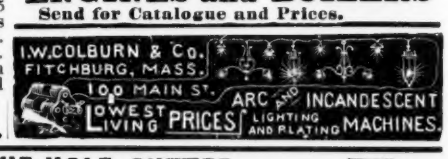

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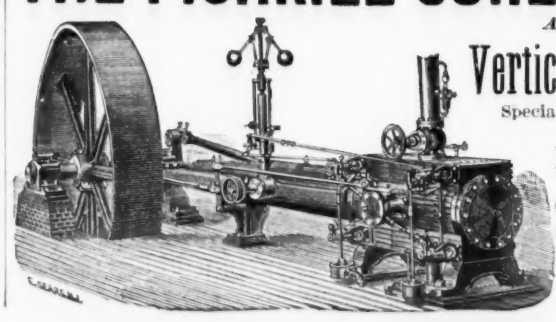

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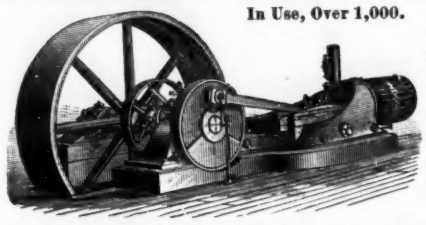

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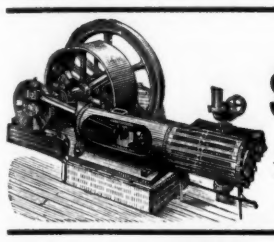

THE BECKETT & McDOWELL MFG. CO.,

STEAM ENGINES, HOISTS, PUMPS,

AND GENERAL MINING MACHINERY.

120 LIBERTY ST., NEW YORK.

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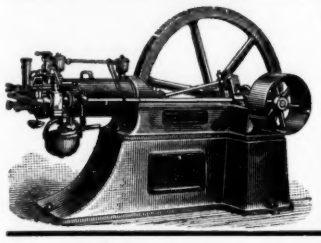


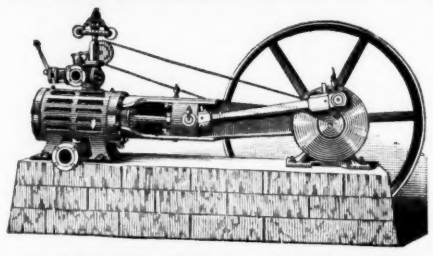
"OTTO" GAS ENGINE WORKS,

SCHLEICHER, SCHUMM & CO.,

33d and Walnut Sts. PHILADELPHIA. Branch Office, 130 Washington St. CHICAGO.

OVER 18,000 ENGINES IN USE.

GUARANTEED To Consume 25 to 75 Per Cent. Less Gas than ANY Other Gas Engine per Brake-horse-power.



STEARNS MFG. COMPANY,

ERIE, PA.

Engines from 15 to 400 Horse Power.

Boilers of Steel and Iron supplied to the trade or the user. Send for Catalogues.

SAW MILLS and GENERAL MACHINERY.

Works at ERIE, PA.

HOISTING ENGINES.

Of any power and Style. SINGLE AND DOUBLE CYLINDER, with improved patent friction drums, especially adapted for bridge building, dock building, pile driving, coal hoisting, quarries, mines, etc.

J. S. MUNDY, Newark, N. J.

This patent has been sustained in U. S. Courts in New York and N. J.

SECOND-HAND TOOLS FOR SALE by

POOLE & HUNT, Baltimore, Md.

1 Planing Machine. Will plane 35in. wide, 27 in. high, and 16 ft. 6 in. long.
1 Planing Machine. Will plane 30 in. wide, 26 in. high, and 5 ft. 6 in long.
1 Planing Machine Will plane 24 in. wide, 22 in. high, and 5 feet long.
1 Double Geared Chasing Lathe. Will swing 24 in. dia., 8 ft. 6 in. long.
1 Drill Grinding Machine.
1 Small Punching and Shearing Machine, with fly wheel and clutch starting arrangement.

MACHINERY,

NEW AND SECOND-HAND.

12 in. S., 5 ft. Bed Engine Lathe, New
14 " 5 and 7 ft. Bed Engine Lathe, Bogert new
14 " 5½ ft. " " " Harris, cheap
16 " 6 ft. " " " Ames.
15 " 6 ft. " " " Pratt & Whitney.
17 " 6 ft. " " " Putnam, not screw cutting.
17 " 6', 7' " " Hewes & Phillips.
18 " 8 ft. " " " Fitchburg, g. o.
19 " 10, 12, 14" " " Pond, nearly new.
24 " 20 ft. " " " Ames, new.
30 " 12 ft. " " " Harrisburg.
34 " 12 ft. " " " Harrisburg, good.
16x6 ft. Turret Lathe with chasing bar.
14 in., 20 in. and 33 in. Turret Head Chucking or Screw Machines, Bridgeport.
23 in., 25 in. and 28 in. Drills, Blaisdell, new.
20 in. Drill, Prentice.
20 " " Davis.
32 " " Pond. Slate's Sensitive Drill.
Elliott Drill. Gang Drill.

SHAPERS.

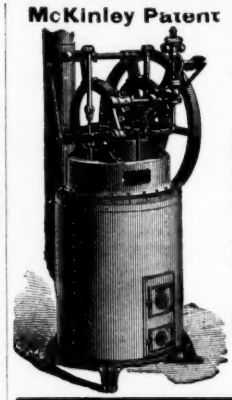
8 in. Gould. 12 in Sellers.
8 in. Boynton & Plummer
15 & 24 in. Wolcott.
24 in. Hendey, 24 in. Bridgeport.

PLANERS.

16x42 in. Bridgeport. 18 in x 3 ft., Wheeler,
24 in x 6 ft., Powell. 24 in x 8 ft. Ames.
26 in. x 6&8 ft., " 22 in. x 4 ft., 5 ft. and 6 ft. Powell.
32 in. x 10 ft., Pond 34in. x 10 ft., P. & W.
36 in. Squaring Shear, power, nearly new.
No. 3½ and 5 Press, Stiles
25-40 lb. Bradley Cushioned Hammer.
Lot of miscellaneous Machinery If you do not see what you want, write and state what is required.

E. P. BULLARD, 14 Dey St., New York.

McKinley Patent



Air Engine.

The Best and Cheapest on the Market.

No Steam. No Water. Absolute Safety. No Engineer. No Pumps. No Gauges. No liability to freeze up. No Regulation required.

NO EXTRA INSURANCE.

Can be used for any purpose where power is required.

Cheap Fuel. Cheap First Cost.

McKinley Engine Co.

17 Broadway, CINCINNATI, O.

NEW TOOLS

FOR SALE.

We have the following tools completed, or nearly so.

1 20 in. x 12 foot bed Engine Lathe.
1 26 in. x 25 " " " "
1 42 in. x 1[illegible] " " Treble Geared Lathe.
1 36 in. x 3[illegible] in. x 9 foot Planer, new design.
2 36 in. x 36 in., any length of bed Planers.
1 60 in Pulley Turning Lathe, two tools.

NEWARK MACHINE WORKS.

East Newark, New Jersey.

MACHINERY.

NEW and SECOND-HAND.

LATHES.

One.. 17 in. x 6 ft. Forsaith Engine Lathe, 2nd-hand
One.. 18 in. x 12 ft. " " "
One.. 16 in. x 6 ft., Fifield, " "
One.. 20 in. x 8 ft. " " "
One.. 21 in. x 8 ft., " " "
Five No. 3 Plain L. D & Co., Hand Speed Lathe, New
One.. 26 in. x 16 ft., " " Engine Lathe "
Five 13 in-x 5 ft. " " Turret " New
Three No. 1 " " Hand, Fox " "
Four 15 in. L. D & Co. Fox Monitors " "
One.. 12 in. " " " " "
Oen 19 in. x 8-10-12" " all in A No. 1 order
One..19-21 in. x 10 ft. Pond Lathe, 2nd-hand
One..30 in. x 22 ft New Haven Lathe, "
One..Gauge Lathe, "

PLANERS.

One..22 in. x 22 in x 6 ft. Powell (good as new), 2d-h'd
One..30 in. x 30in x 8 ft. Pond, "
One.. 24 in. x 24 x 6 ft. Wood & Light " "
One..18 in. x 16 x 3ft. 6 in. Putnam New
One..24 x 24in. x 6 Pease New
One..20 x 20 in. x 4 ft. Williams Planer, New
One..24 x 24 in. x 5 ft. Whitcomb " 2nd-hand
One..20 x 20 x 4in. 6 ft. Putnam, "
One..20 in. Steptoe Shaper, 2nd-hand
Two 20 in. L. D. & Co. Shapers, New
Two 26 in " " " "
One..32 in. " " " "

DRILLS.

Six ..24 in. Bickford Drill, New
One..24 in. Bickford Drill, 2nd-hand
One..20 in. L. D. & Co. Lever Drill, "
Six ..20 in. L. D & Co. " " New
Three 28 in. Bickford B. G. & S. F. Drill "
Three 32 in. " " " " "

MISCELLANEOUS.

Two Grant & Bogert Universal Millers, New
One..Small Valve Miller, "
One..Sellers Car Wheel Borer, 2nd-hand

☞ (See Advertisement on page 16.)

LODGE, DAVIS & CO.

Manufacturers and Dealers,

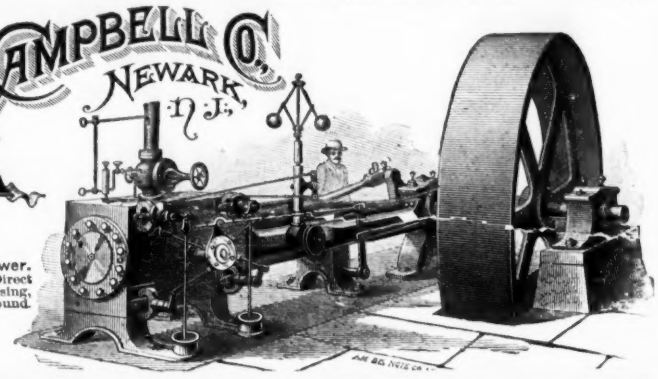
CINCINNATI, OHIO.

The Watts, Campbell Co.,

Newark, N. J.

MANUFACTURERS OF IMPROVED CORLISS STEAM ENGINES IN FULL VARIETY.

Sizes varying from 30 to 2000 Horse Power. Horizontal or Vertical, Direct Acting or Beam, Condensing, Non-Condensing or Compound. Send for Circular.



HEWES & PHILLIPS Iron Works.

IMPROVED

Corliss Engine,

High Pressure,
—Condensing—
And Compound

Send for Circular.

AGENT:
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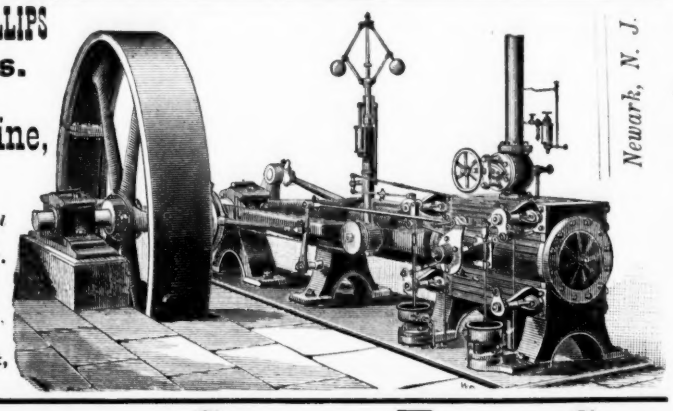
(175 Temple Court)
7 Beekman Street,
NEW YORK.

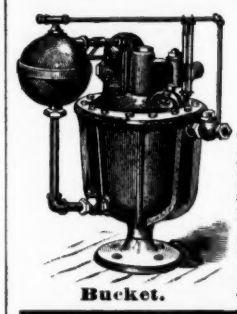


Newark, N. J.

THE ALBANY STEAM TRAP CO.'S

BUCKET AND GRAVITATING

TRAPS.

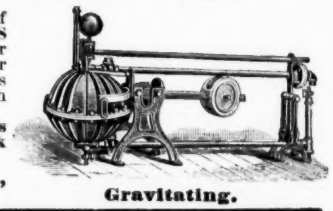


Bucket.

Automatically drain the water of condensation from **HEATING COILS** and return it to the boilers whether the coils are **above** or **below** the water level in boiler, doing away with pumps and other mechanical devices for such purposes.

We also manufacture **Blessing's Patent Renewable Seat Stop and Check Valves.**—Send for Circular.

Albany Steam Trap Co. Albany, N. Y.

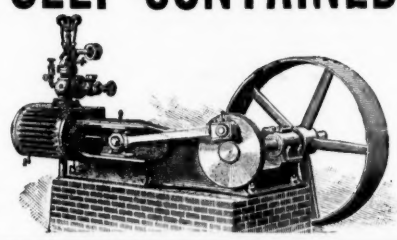


Gravitating.

SELF-CONTAINED STEAM ENGINES.

Stationary or Semi-Portable.

High Standard Maintained. Prices greatly Reduced. Write for New Illustrated Catalogue No. 22



CHANDLER & TAYLOR, Indianapolis, Ind.

ENGINES, SAW MILLS, AND DRAIN TILE

MACHINERY A SPECIALTY.

S. ASHTON HAND MFG. CO.,

Toughkenamon, Chester Co., Pa.

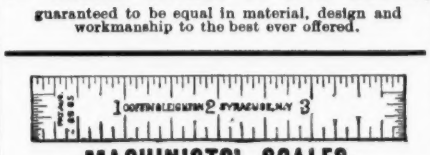
MAKERS OF FIRST-CLASS

ENGINE LATHES

Are now in position to put on the market

14" ENGINE LATHES OF NEW DESIGN,

guaranteed to be equal in material, design and workmanship to the best ever offered.



MACHINISTS' SCALES,

Patent End Graduation.

We invite comparison for accuracy with all others. Every Scale Guaranteed. Send for List.

COFFIN & LEICHTON, SYRACUSE, N. Y.

PATENT UNIVERSAL SCREW-CUTTING, CENTER, DEPTH ANGLE AND

J. WYKE & CO. TWIST DRILL GAUGE.

Fine Machinists' Tools, E. BOSTON, MASS. Send for Circular.

EXTRA HEAVY LATHE

WE ARE MAKING A SPECIALTY OF A 24-INCH LATHE, WITH BED ANY LENGTH DESIRED. THIS LATHE IS DESIGNED FOR SEVERE SERVICE; IT IS THE HEAVIEST OF ITS SIZE EVER PRODUCED, AND THE WORKMANSHIP AS GOOD AS SKILL CAN MAKE IT.

SEND FOR CIRCULAR.

S. S. HEPWORTH & CO., "Glenwood Station," Yonkers, N. Y.

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Send for 72-Page ILLUSTRATED CATALOGUE.

WM. T. COMSTOCK, 6 Astor Place, - New York.

UPRIGHT POWER HAMMER.

This Hammer possesses advantages superior to any other in the market. It has neither cylinders, valves or piston rods, consequently repairs are trifling. It takes up less space, less power to drive; strikes much harder and truer blows than hammers with double the weight of ram.

It can be worked to strike good alternate blows on a 3-inch and ¾-inch bar when a 100-pound hammer is used, and can be used on die work to a far greater advantage than any other hammer known. Manufactured by the

E. A. BELDEN CO., Danbury, Conn

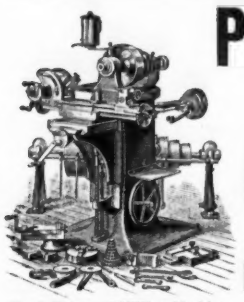
SEND FOR SPECIAL LIST.

New and Second-hand Machinery.

COLD-ROLLED SHAFTING, HANGERS, PULLEYS, ETC., ETC.

GEORGE PLACE MACHINERY CO.

121 Chambers St., New York.



PRICES REDUCED.

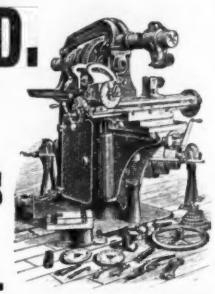
THE ORIGINAL

Universal Milling Machines

MADE BY THE

BROWN & SHARPE MFG. CO.

PROVIDENCE, R. I.,



No. 1 Universal Milling Machine.

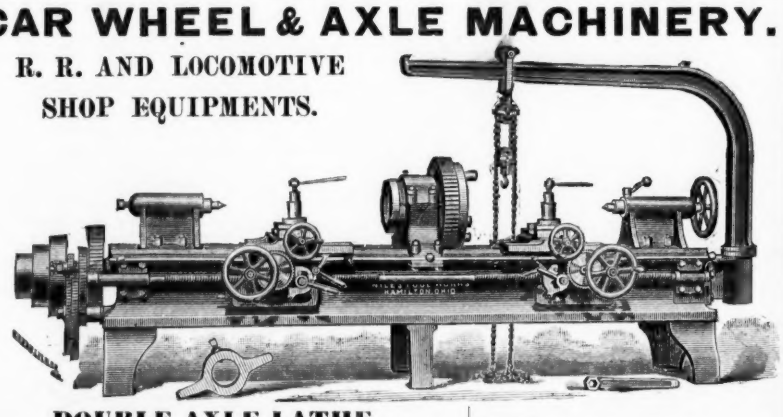
No. 3 Universal Milling Machine.

Are kept in stock and sold at favorable prices, compared with any of their **IMITATIONS.** *By making these Machines in large numbers, with expensive special tools, much greater accuracy has been attained than can be reached by the usual methods of manufacture. The importance of the greatest attainable accuracy in* **TOOL-MAKING MACHINES** *will be appreciated by Machinists.*

CORRESPONDENCE SOLICITED CATALOGUE MAILED ON APPLICATION

CAR WHEEL & AXLE MACHINERY.

R. R. AND LOCOMOTIVE SHOP EQUIPMENTS.

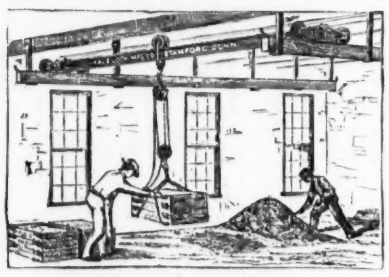


DOUBLE AXLE LATHE.

NILES TOOL WORKS,

HAMILTON, OHIO.

NEW YORK, 96 Liberty St.
PHILADELPHIA, 713 Chestnut St.
CHICAGO, 96 Lake St.



PULLEY BLOCK TRAVELER.

TRAVELERS

WITH

Weston's Differential Pulley Blocks,

ANY CAPACITY.

The bridge has longitudinal motion on the tracks, and the trolley transverse motion on the bridge, so that the load may be picked up at any point between the tracks, raised to any height, and laid down at any other point.

SOLE MAKERS,

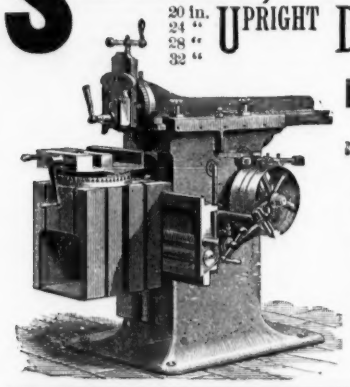
THE YALE & TOWNE MFG. COMPY.

STAMFORD, CONNECTICUT.

New York—Chicago—Philadelphia—Boston. Catalogues on application.

SHAPERS, TURRET LATHES AND DRILLS

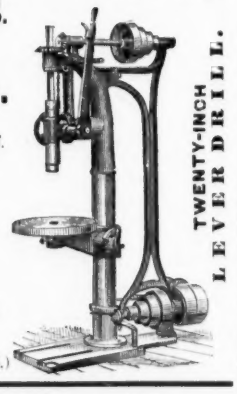
20 in. 24 " 28 " 32 " UPRIGHT DRILLS, 28 in. Back-geared and 32 " Power-feed DRILLS.



LODGE, DAVIS & Co.

CINCINNATI, OHIO.

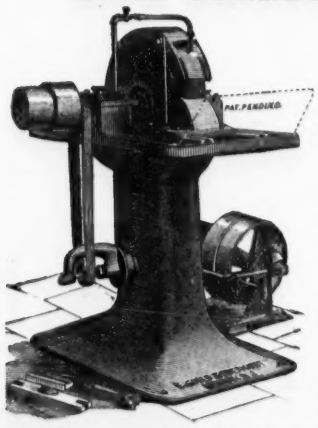
Send for Prices, IT WILL PAY YOU.



TWENTY-INCH LEVER DRILL.

(See our advertisement on page 15.)

EBERHARDT'S EMERY TOOL GRINDER.



WILL NOT Draw the TEMPER or WET THE FLOOR.

WILL SHIP on its Merits.

WRITE TO GOULD & EBERHARDT,

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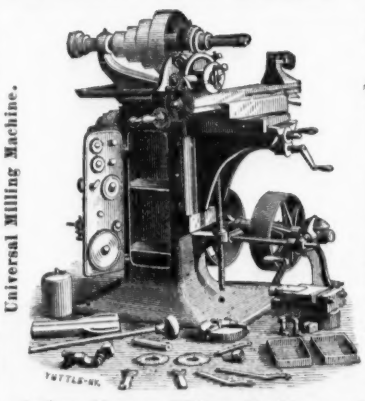
E. E. CARVIN & CO.,

MANUFACTURERS OF

Machinists and Iron Workers' Tools.



Universal Milling Machine.

WE RECEIVED GOLD MEDAL FOR OUR NEW UNIVERSAL MILLER AT NEW ORLEANS EXHIBITION. (See cut.)

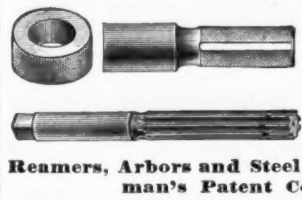
Lathes, Planers, Milling Machines and Drills. Special Tools for all kinds of manufacturing to order. Gear and Rack Cutting, Milling and Index Drilling to order.

Nos. 139 to 143 CENTRE ST., NEW YORK.

THE PRATT & WHITNEY CO.

Hartford, Connecticut.

MANUFACTURE STANDARD SIZE



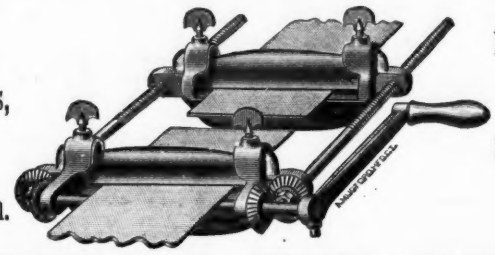
Cylindrical and Caliper Gauges,

And End Measure Test Pieces.
Straight and Taper Solid Hand Reamers, Chucking and Shell Reamers, Arbors and Steel Mandrels, Corundum Wheels, Cushman's Patent Combination Lathe Chuck.

PRICE LIST and DISCOUNT SHEET furnished on application.

THE BILLINGS & SPENCER CO., Hartford, Conn.

Belt Clamps, IN Eight Sizes, FROM Eight Inch TO Thirty-six Inch.



Machinists' Tools, Sewing Machine Shuttles AND Bobbins.

DROP-FORGINGS OF EVERY DESCRIPTION.

SEND FOR CIRCULAR.

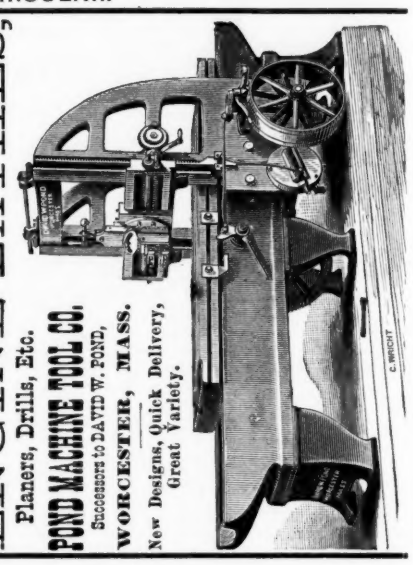
WARNER & SWASEY,

MACHINE TOOLS CLEVELAND, OHIO.

For IRON and BRASS WORK.

Illustrated Catalogue on application.

ENGINE LATHES,



Planers, Drills, Etc.

POND MACHINE TOOL CO.

Successors to DAVID W. POND,

WORCESTER, MASS.

New Designs, Quick Delivery, Great Variety.

GEO. W. FIFIELD,

MANUFACTURER OF

ENGINE LATHES

FROM 16 to 48 IN. SWING.

Cuts, Photographs and Prices furnished on application.

Lowell, Mass., U. S. A.

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO.

HARTFORD, CONN.

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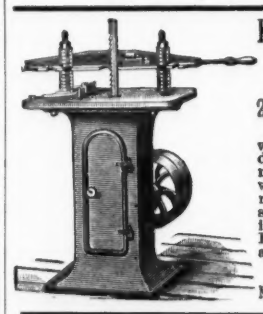
GEAR WHEELS & GEAR CUTTING.

Send for Catalogue D.

GEORGE B. GRANT,

666 Beverly Street, Boston.



KEY-SEATING MACHINES AND 20-in. Drills a Specialty.

Our Key-Seating Machine will save enough in 60 days' use to pay first cost; no shop can afford to do without one. We have now ready for prompt shipment, both Key-Seating Machines and 20-inch Drills. Send for Photo. and Catalogue.

W. P. DAVIS,

NORTH BLOOMFIELD, N. Y.

For New Reduced PRICE LIST, Write

Lathes, 17 in. 20 in.
Planers 24"x24" 20"x30"

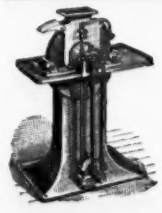
THE G A. GRAY CO.

Sycamore & Webster St., Cincinnati, O.

THE BUFFALO STEEL FOUNDRY, BUFFALO, N.Y.

ORDERS AND CORRESPONDENCE SOLICITED.

PRATT & LETCHWORTH Proprietors.



The Stiles Machinist Tool Grinder.

FOR GRINDING LATHE, PLANER AND OTHER TOOLS,

—MANUFACTURED BY—

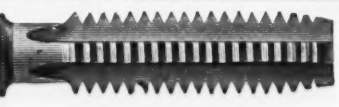
THE STILES & PARKER PRESS CO.

MIDDLETOWN, CONN.

Branch Works and Office:

203, 205, 207 Centre Street, corner of Howard, New York.

J.M. CARPENTER PAWTUCKET, R.I.



Manufacturer of TAPS AND DIES